











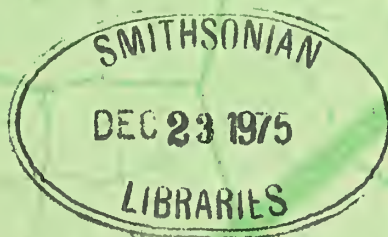




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Flora of Micronesia,  
2: Casuarinaceae, Piperaceae,  
and Myricaceae

F. RAYMOND FOSBERG  
and  
MARIE-HÉLÈNE SACHET



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*F. Raymond Fosberg*  
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## ABSTRACT

Fosberg, F. Raymond, and Marie-Hélène Sachet. Flora of Micronesia, 2: Casuarinaceae, Piperaceae, Myricaceae. *Smithsonian Contributions to Botany*, number 24, 28 pages, 1 figure, 1975.—The second installment of the Flora of Micronesia gives systematic treatments, including descriptions, synonymy, pertinent literature references, keys, ethnobotany, citations, geographic records, and specimens examined, of the families Casuarinaceae, Piperaceae, and Myricaceae.

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## Contents

	<i>Page</i>
Introduction .....	1
Casuarinaceae .....	1
<i>Casuarina</i> L. ....	1
Piperaceae .....	6
<i>Peperomia</i> Ruiz & Pavón .....	6
<i>Piper</i> L. ....	16
Synonyms and Excluded or Misapplied Names .....	26
Myricaceae .....	27
<i>Myrica</i> L. ....	27
Literature Cited .....	27
Index .....	28





# Flora of Micronesia, 2: Casuarinaceae, Piperaceae, and Myricaceae

*F. Raymond Fosberg  
and Marie-Hélène Sacht*

## Introduction

This second installment of the Flora of Micronesia follows essentially the same format as the first installment (*Smithsonian Contributions to Botany*, number 20). Treated in this installment are the families Casuarinaceae, with one genus and one Micronesian species; Piperaceae, with 2 genera, 15 native and 4 introduced species, including a number of minor taxa; and Myricaceae, with one introduced genus and one species.

More complete bibliographic references may be found in Sacht and Fosberg, *Island Bibliographies* (1955), and *Supplement* (1971), with a complete list of serial abbreviations.

For details of the history and circumstances of the present flora, as well as an explanation of its scope and arrangement, reference may be made to the introductory pages of the first installment.

It may be useful to restate here that in citations of specimens the collector and number are italicized if the specimen has been examined by the authors. Herbarium symbols are according to the 5th edition of *Index Herbariorum* (Lanjouw and Stafleu, 1964), with the additions: "UH" for University of Hawaii, "UG" for University of Guam, and "Fo" for specimens still in possession of the authors. Such sym-

bols are only cited for sheets actually studied, not for sheets that are known to be in other herbaria but not examined in this study.

## CASUARINACEAE

Trees with cylindrical, articulate, striated green branchlets which serve as leaves; the true leaves reduced to whorls of minute scales at the nodes; flowers monoecious or dioecious, much reduced, without perianth, arranged in aments, wind pollinated, the staminate aments cylindric, articulate; pistillate aments capitate, developing into woody cone-like structures formed from thickened indurate floral bracts; fruit a samara with a single wing.

A family of a single genus (by some regarded as two), principally Australasian.

### *Casuarina* L.

*Casuarina* L., Diss. Stickman, 12, 1954 [as *Casaarina*, sphalm.];  
Amoen. Acad., 4:143, 1759.

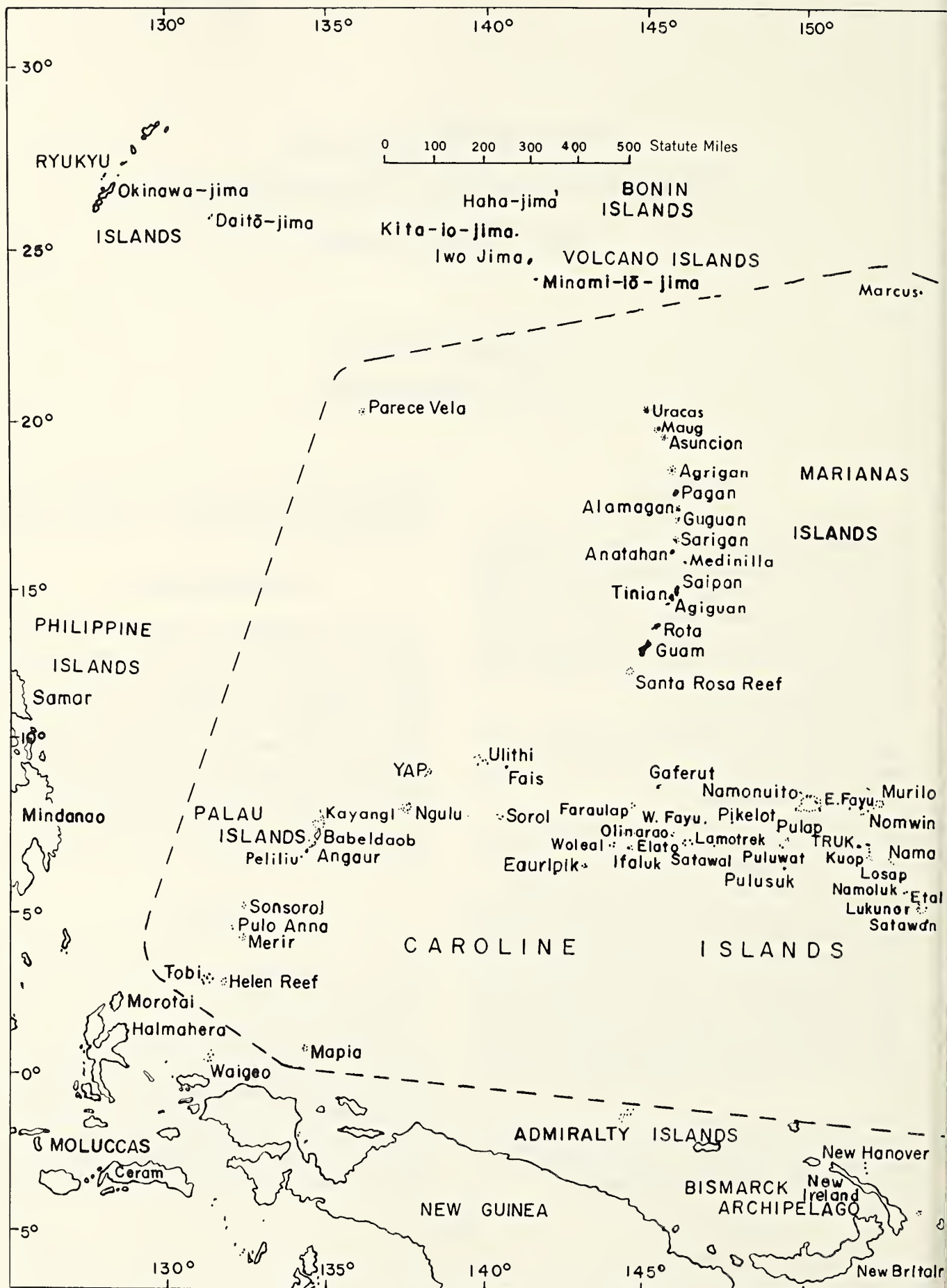
#### Characters of the family.

A small genus, principally Australian, with several species in New Caledonia, New Guinea, and Malesia, one widespread in the Indo-Pacific region, including the high islands of Micronesia, and generally introduced in the tropics and subtropics.

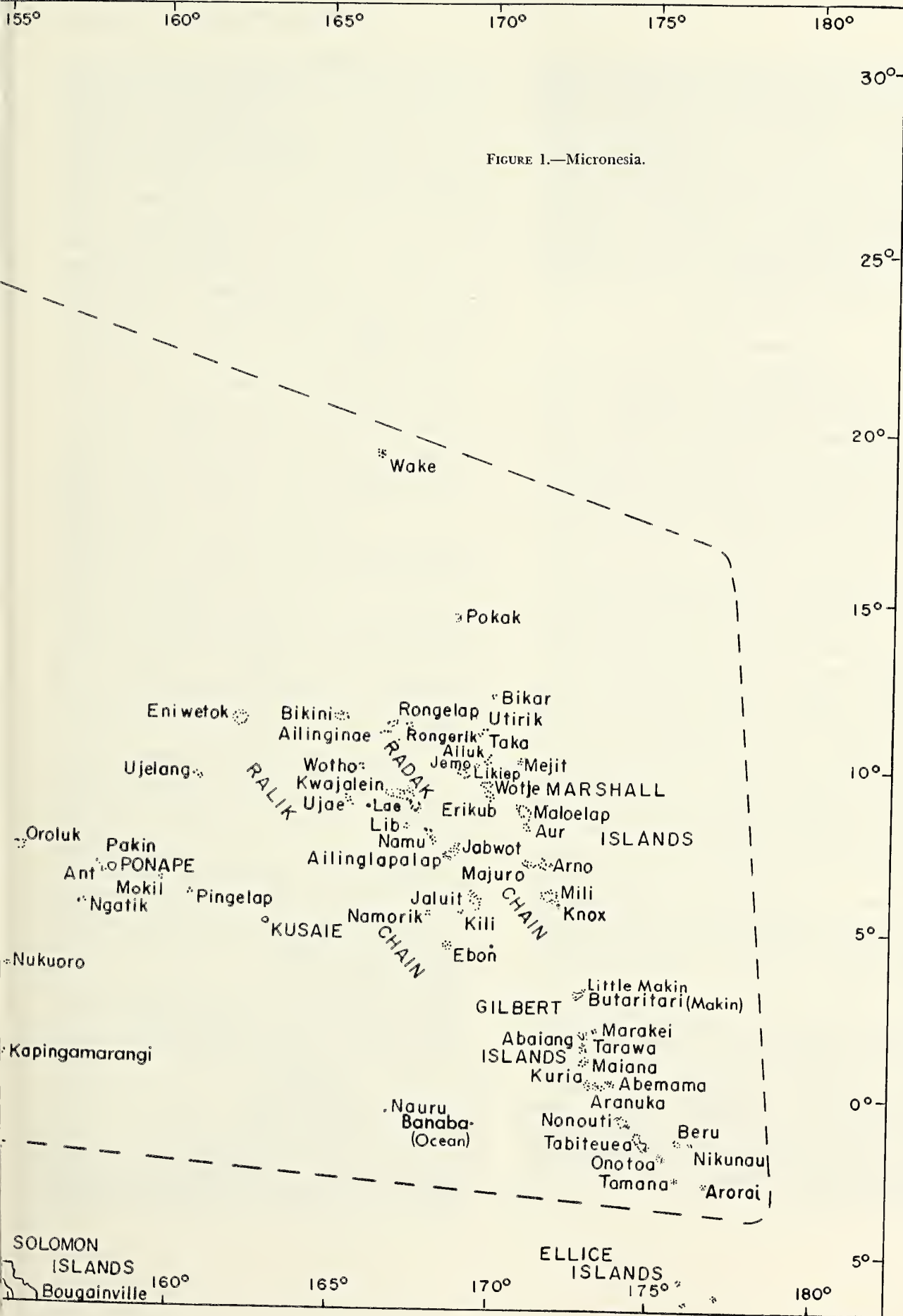
There has been much uncertainty about the validity of publication of this generic name by Lin-

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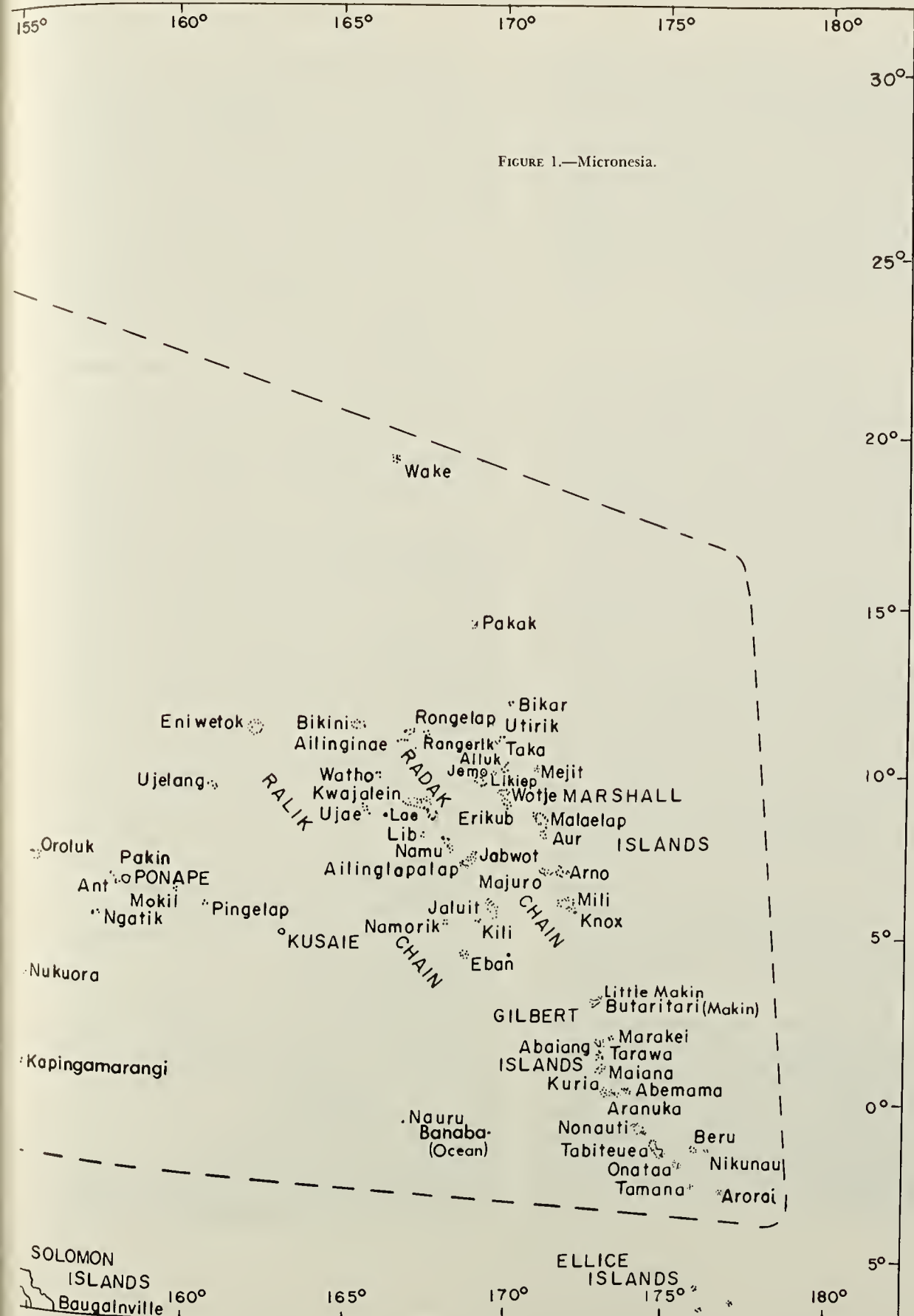
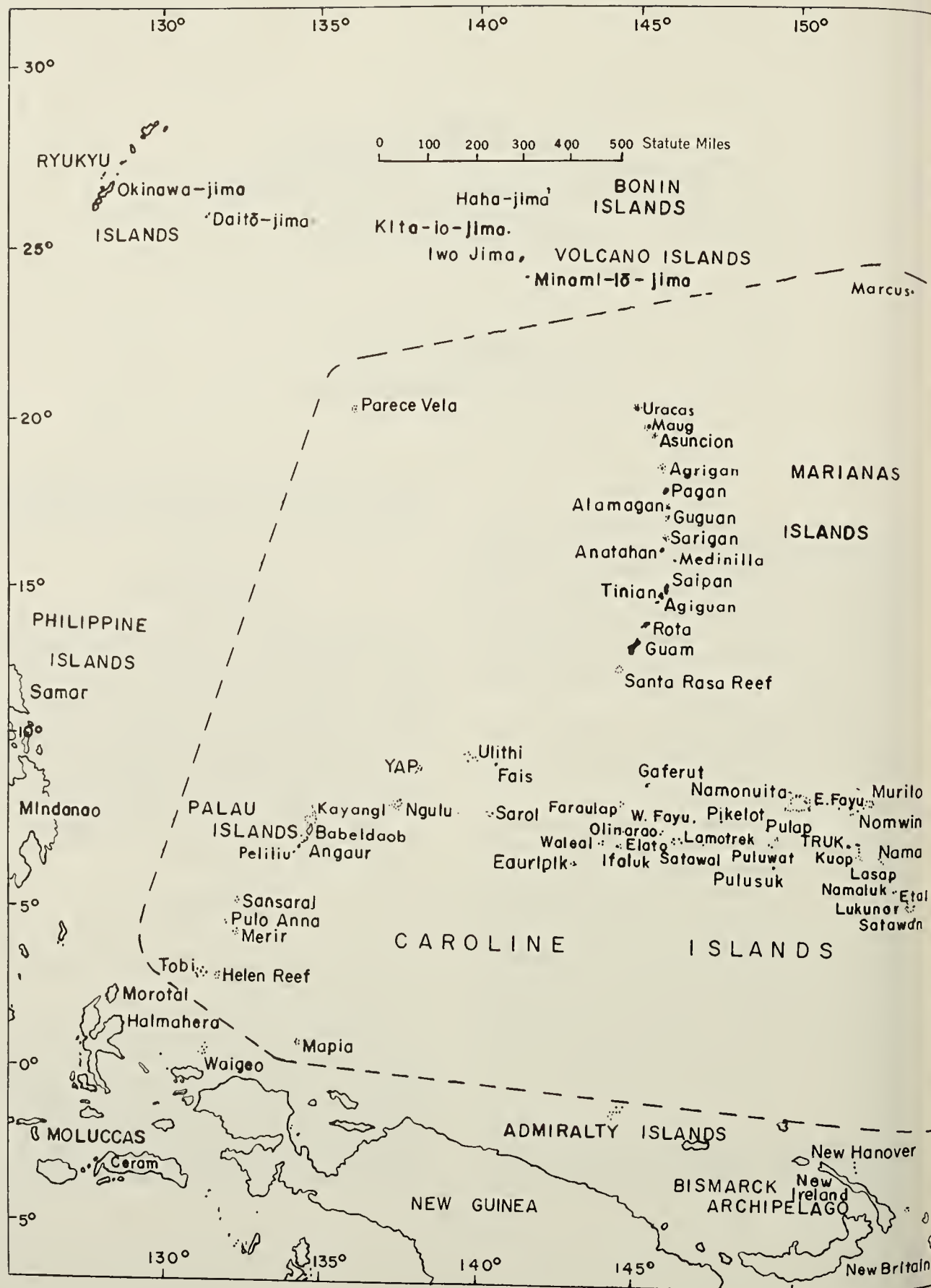


FIGURE 1.—Micronesia.

naeus, as it is not accompanied by a description. However, under the International Code, the reference to an earlier description and plate of the type-species by Rumphius (1743:86, pl. 57) serves to validate it, since it was a monotypic genus as treated by Linnaeus. The same application of Article 42 of the *International Code of Botanical Nomenclature* makes it necessary to accept the binomial *Casuarina litorea* in place of the widely familiar *C. equisetifolia*. This situation will be discussed at length in another paper.

### *Casuarina litorea* L.

*Casuarina litorea* [Rumphius] L., Diss. Stickman, 12, 1754 [as *Casaarina litorea*, sphalm.] [type Rumphius, vol. 3, pl. 57]. *Casuarina equisetifolia* L., Amoen. Acad., 4:143, 1759 [as *equisetifolia*, sphalm.].—Thomas, Jour. Voy. South Seas 168, 1745.—Chamisso, Remarks and Opinions, 77, 1821.—Miquel in de Candolle, Prodr. 16 (2):339, 1868.—Kubary, Ethn. Beitr. Kenntn. Karol. Arch., 101–102, 1895.—Schumann and Lauterbach, Fl. Deutsche Schutzg. Süds., 254, 1901.—Fritz, Mitt. Deutsch. Schutzg., 15:96–118, 1902.—Safford, Contr. U.S. Nat. Herb., 9:220, 1905.—von Prowazek, Deutschen Marianen, 115, 1913.—Merrill, Phil. Jour. Sci. Bot., 9:71, 1914.—Corte [transl.], Guam Recorder, 3:158, 330, 1926 [repr. 1972].—Kanehira, Bot. Mag. Tokyo, 45:274, 1931; Fl. Micr., 80, 1933.—U.S.D.A., Ann. Rept. Guam Agr. Expt. Sta., 1932:17, 1933.—Hosokawa, Kudoa, 2:107–113, 1934.—Kanehira, Enum. Micr. Pl., 303, 1935.—Okabe, Jour. Anthropol. Soc. Nippon, 56:423, 1941; Nankyo, 2:18, 1943.—Okabe, Netti Sangyô Kenkyu-sho hô, 5:2, 1940.—Tuyama, Kagaku Nanyô, 4:16, 1941.—Bryan, Plants of Guam [unpub., 1946?].—Thompson, Guam and Its People, ed. 3, 200, 1947.—Burcham, Contr. U.S. Nat. Herb., 30:430, 1948.—Guillaumin, Bull. Soc. Bot. France, 99:39, 1952.—Glassman, Bishop Mus. Bull., 209:79, 1952.—Glassman, Pac. Sci., 7:295, 1953.—Catala, Atoll Res. Bull., 59:88, 1957.—Stone, Pac. Sci., 13:100, 1959.—Fosberg, Atoll Res. Bull., 67:11, 1959.—Fosberg and Sachet, Atoll Res. Bull., 92:14, 1962.—Whiting, m.s., 1965.—Fosberg and Sachet, Atoll Res. Bull., 123:7, 1969.—Stone, Micronesica, 6:241–242, 1971.—Fosberg, Falanruw, and Sachet, Smithsonian Contr. Bot., 22:20, 1975. *Casuarina mertensiana* Ruprecht ex Miquel in de Candolle, Prodr., 16 (2):339, 1868 [type from Guam, Mertens, Chamisso, not seen by us].

Tree, reaching a large size, heart-wood very hard and heavy; branchlets jointed, joints about 1 cm long, about 1 mm or less thick, with 6–8 striae; leaves in whorls of 6 to 8; flowers monoecious to dioecious, staminate in cylindric elongate aments, pistillate in shorter turbinate aments, styles maroon, filiform, fruiting aments cylindric to globose, about 1–1.5 cm thick, up to 2 cm or more long; fruit with a transparent wing.

Indo-Pacific region from East Africa to the Society and Marquesas Islands, north to the Bonins (probably introduced) and Ryukyus. In Micronesia in the Marianas: Maug, Agrigan, Pagan, Alamagan, Anatahan, Saipan, Tinian, Rota, Guam. Carolines: Palau, Mapia, Yap, Namonuito, Truk, Satawan, Ponape, Mokil. Marshalls: Kwajalein, Likiep, Jaluit. Nauru. Gilberts: Butaritari, Tarawa. In the atolls and probably Nauru it is regarded as introduced. What was probably this species was reported from Tinian as “Red-Wood-Tree” or “Iron Wood” by Thomas (1745:168), who visited the island with Anson in 1742.

Found on strands, cliffs, and other open habitats, becoming established as a pioneer on mineral soil, either of limestone or volcanic origin, or even on fresh lava or volcanic ash, apparently able to invade grassland, persisting for a long time in forests but not invading closed woody vegetation. Under a stand of *Casuarina*, in relatively dry or well-drained areas, few plants of any kind become established, apparently because of the thick accumulation of fallen branchlets or “needles”; but in wetter areas these decompose more rapidly and many plants grow in the resulting humus layers. Characteristic complex-branching nodules on the *Casuarina* roots are apparently related to the demonstrated nitrogen-fixing ability of the genus. On Guam, when the savannas are protected from fire, they tend to grow up to *Casuarina* forests.

USES.—The wood is heavy, strong and very hard, but in Guam it is scarcely at all utilized as it is hard to work (Safford, 1905). Used for abortions (Thompson, 1947:200). “Roots are used in a medicinal tea. Roots and trunk (?) ‘without bark’ are used in a douche, reputedly as an abortifacient. Wood of the tree is burned as a mosquito repellent” (Guam: Whiting, ms, 1965). An astringent principle is obtained from the bark and is used for chronic diarrhea (Okabe, 1940:2).

#### VERNACULAR NAMES.—

ironwood, beefwood, red-wood tree, Polynesian ironwood, she-oak, Australian pine (English)  
gago (Marianas: von Prowazek, 1913)  
gago (Pagan: Corte, 1926)  
goago (Rota: Kanehira, 1935)  
gagu (Rota: Fosberg 24992)  
agoho or gago (Guam: Corte, 1926)  
gago (Guam: Fosberg 25363, Marche 142, Nelson 133, Stone 4247, Whiting C9; Safford, 1950; Mer-



rill, 1914; Corte, 1926; Bryan, 1946)  
 gagu (Guam: Stone, 1971)  
 gao-gao (Guam: *Dutton 130*)  
 agas (Palau: Okabe, 1943, n. 18)  
 agasu (Palau: Okabe, 1941:423)  
 ngas (Palau: Walleser and Krämer in Tuyama, 1941; *Emmons 2*)  
 ngasu (Palau: Kanehira, 1935)  
 noc (Yap: *Wong 465*)  
 lach (Ulithi: *Fosberg 46613*)  
 ueuhir (Satawal: *Fosberg 46851*)  
 neokuk (Satawan, Ta I.: *Anderson 1058*)  
 ueoku (Satawan, Moch I.: *Anderson 1000*)  
 ueokuk (Satawan, Ta I.: *Anderson 1058*)

#### GEOGRAPHIC RECORDS AND SPECIMENS EXAMINED

MARIANAS ISLANDS.—*Gaudichaud* (P); planted on Uracas, Asuncion, Guguan, and Medinilla by Fritz, 1902:96–118.

Maug: Seen by Falanruw in 1972.

Agrigan: Fritz, 1902:110; trail around south side of island, on cliffs and bluffs, 10–20 m, *Fosberg 31578* (US, BISH, Fo, NY, L).

Pagan: *Hosokawa 7949* (US, Fo), 7989 (BISH); *Bonham 20* (US, Fo); *Kondo* in 1949 (BISH); Fritz, 1902:106; isthmus, planted in rows near pier on west side of isthmus, *Anderson 580* (US, BISH, Fo, NY, L); Mt. Charlen, on fresh lava flow east of Fresh Water Lake, *Fosberg 31411* (US, BISH, Fo, NY, L); Lagona, *Villagomez JV-02* (US); Mt. Pagan crater floor, *Moore 371* (US).

Alamagan: Around Partido village, on sea bluffs, *Fosberg 31646* (US).

Anatahan: Fritz, 1902:98; boulder strewn beach area, sea level, *Falanruw 1660* (US); northwest tip of island, 0–10 m, *Evans 2447* (US, BISH, Fo, NY).

Saipan: *Stephens 51* (Fo), 85 (Fo); *Marche 1* (P, Fo); *Kanehira 1013* (FU, 2 sheets); southwest corner of island, just north of Agingan Pt., 1–3 m, *Fosberg 25257* (US, BISH, Fo, NY, L); *Kanehira & Hatusima 4408* (FU); Marpi, *Courage 19* (US); near ISCOM Base Command, center of island, 600 ft [180 m], *Conover 956* (US, BISH).

Agiguan: *Kondo* in 1952 (BISH).

Tinian: Thomas, 1745:168; *Kondo 33* (BISH); *Cameron* in 1944 (BISH); Mt. Lasso, 150–175 m, *Fosberg 24889* (US, BISH, Fo).

Rota: *Grether 4461* (UC); *Necker R46* (US); northwest coast of west end of main part of island,

between Rota and Tataacho Pt., *Fosberg 24992* (BISH); Taipinkoto, *Hosokawa 7657* (BISH, Fo); Songsong village and vicinity, 5–10 m, *Evans 2031* (US); just behind the west dock, 5–10 m, *Evans 1971* (US, BISH, Fo, NY).

Guam: *Mertens* (P); *Marche 142* (P); *McGregor 538* (US, BISH, UC); *G.E.S. 431* (US, BISH); Chamisso, 1821:77; Agaña, *Seale* in 1900 (BISH); 4 km east of Agat, *Necker 113* (US, BISH); Agfayan Bay, within 100 m of shore, *Necker 136* (US, K); 1 mile [1.6 km] south of Barrigada, 400–600 ft [120–180m], *G. C. Moore 38* (US, UC); near top of Mt. Tenjo, *Rodin 544* (UC); along ocean, south of Ylig River, *Rodin 822G* (US, UC); Manengon, 150 m, *Evans 1789* (US, UH, Fo, K, MO); Manengon, Tarzan Falls, *B. C. Stone 4976* (US, UG); Harmon village, *Stone 4247* (BISH, UG); Merizo, *Whiting C9* (US, Fo); along beach, *Fosberg 25363* (US, BISH, Fo, NY, L); Masso, *Nelson 133* (BISH); Dadi Beach, Sumay, *Bryan 1211* (BISH, K); between Umatac and Cetti Bay 0–10 m, *Evans 1555* (US, BISH, Fo, NY, L, P); Yigo, *Dutton 130* (US, BISH, Fo).

CAROLINE ISLANDS.—Palau: *Ledermann 14052* (K). Kayangl: *Salsedo 401* (US). Balbeldaob: Arekalong, *Takamatsu 1664* (US, UC, K). Koror: Entomology Lab. *Emmons 2* (US); Ngerdis, site of old Japanese plane ramp, *Salsedo 67* (US). Ngarakabesang (Arakabesan): *Takamatsu 1254* (BISH); west peninsula of island, 10–20 m. *Fosberg 32470* (US, BISH, Fo). Ngeanges (Gaingas): in Yoo (Sar) Passage, just west of south point of Urukthapel, 2 m, *Fosberg 25838* (US, BISH, Fo, NY, L). Peliliu: Burcham, 1948:430. Angaur: Kanehira, 1931:274 (citing Kanehira 574); *Kanehira 1075* (FU); north-west coast, on bluffs above sea, 30 m, *Fosberg 25929* (US, BISH).

Mapia: Kubary, 1895:101–102.

Yap: 75 ft [23 m], *Wong 465* (US, BISH Fo).

Ulithi Atoll: Asor I., 1–2 m, in village, planted, *Fosberg 46435* (US); Falalap I., 1–3 m, *Fosberg 46613* (US).

Satawal I.: north side of island, just back of beach, one tree seen, 2 m, *Fosberg 46851* (US).

Namonuito: Ulul I., Stone, 1959:100.

Truk: Moen (Harushima): *Takamatsu 262* (BISH). Dublon (Natsushima): *Takamatsu 4* (BISH). Udot: *Hosaka 2739* (US, BISH, Fo).

Satawan: Moch I., *Anderson 1000* (US, BISH, Fo, NY, L); Ta I., *Anderson 1058* (US, BISH, Fo, NY, L).

Ponape: Colonia, *Glassman* 2912 (US, BISH).

Mokil: Glassman, 1953:295.

WAKE ISLAND.—Seen commonly planted around buildings by Fosberg in 1953, Sachet in 1961, and by Fosberg and Sachet in 1963.

MARSHALL ISLANDS.—Kwajalein: Growing in pot, 1956, seen but not collected by Fosberg; Kwajalein I., *St. John* 23700 (BISH).

Likiep: Likiep I., *Fosberg* 36630 (US, BISH, Fo, NY).

Jaluit: Jabor, *Lyman* 7 (US, BISH, Fo, NY); *Fosberg* 39469 (US).

NAURU ISLAND.—Several trees introduced from Australia, Burges in 1933 (unpubl.).

GILBERT ISLANDS.—Butaritari (Makin): *Catala* 65 (P). Tarawa: Seen in garden of Residency at Bairiki by Catala, 1957:88; seen at Bairiki, Betio and Bikenibeu by Sachet in 1967; Bikenibeu I., *Herbst* & *Allerton* 2659 (US); Betio *Adair* 56 (US).

***Casuarina litorea* var. *souderi* (Fosberg)  
Fosberg & Sachet, new combination**

*Casuarina equisetifolia* var. *souderi* Fosberg, *Micronesica*, 2:144, 1966.

Branchlets fastigiately arranged, internodes so shortened that the scale-like leaves are imbricate.

Apparently endemic to Guam and very rare there, doubtless a mutation that has arisen from the common form and persists on Guam.

MARIANAS ISLANDS.—Guam: Orote, Naval Station, *Souder A-1* (BISH, type, US, Fo).

## PIPERACEAE

Shrubs, vines or herbs; leaves simple, entire, alternate, opposite, or whorled; flowers in spikes or racemes, much reduced, without perianth, but each subtended by a peltate bract, or surrounded by 3 bracts, perfect or unisexual; stamens 2 or more, anthers usually 2-celled; ovary 1-celled with 1 basal ovule, stigmas 1 to several, sessile; fruit a drupe or a minute sticky nut.

A pantropical family found in many habitats but common in forest undergrowth, epiphytic, and on rocks. Two very large genera, *Piper* and *Peperomia*, are usually recognized, but some botanists divide *Piper* into several genera. A conservative course is followed here, admitting only the two, keeping *Piper* intact. Both genera are well-represented in Micronesia.

### Key to the Micronesian Genera of Piperaceae

Woody plants, flower with several stamens and stigmas, and 3 bracts, fruit a drupe ..... ***Piper***  
Herbaceous plants with fleshy stems and (usually) leaves, flower with two stamens, one stigma,  
and one peltate bract; fruit a sticky nutlet ..... ***Peperomia***

### ***Peperomia* Ruiz & Pavón**

*Peperomia* Ruiz & Pavón, *Prodr. Fl. Peru*, 8, 1794.—Kanchira, *Enum. Micr. Pl.*, 303, 1935.—Hosokawa, *Trans. Nat. Hist. Soc. Formosa*, 25:119, 1935.—Yuncker, *Occ. Pap. Bishop Mus.*, 14:7-25, 1938; 22:96-97, 1959.—Fosberg, *Phytologia*, 13:233-234, 1966.

*Micropiper* Miquel, *Comment. Phytogr.*, 39, 1840.

Herbs, usually fleshy; leaves alternate, opposite, rarely whorled, in Micronesian species with palmate venation, petioles expanded or not at base; spikes terminal, leaf-opposed, or axillary, fleshy, lower leaves on stems often reduced; flowers bisexual, reduced to an ovary and two stamens subtended by

a stalked peltate bract; fruit a very sticky minute nut or nut-like drupe (usually described as a berry).

Pantropical, with a number of ill-distinguished species in Micronesia. Common in moist or wet forests, epiphytic or terrestrial, especially on rocks. Several species are grown as ornamental foliage-plants, including, in Micronesia, *P. obtusifolia* (L.) A. Dietrich, seen as a pot plant in Guam and Likiep (*Fosberg* 36724 (US)) and *P. caperata* Yuncker, also said to be grown on Guam. It is probable that the smooth peltate-leaved species *P. argyreia* Morren (*P. sandersii* C. de Candolle) is grown as a pot plant in Guam or other islands, but no collections or records are available.



Key to Micronesian Species of *Peperomia*

1. Leaves cordate or peltate ..... 2
  2. Stem short, leaves rather congested, mostly peltate, bullate, petioles longer than blades ..... *P. caperata*
  2. Stem elongate, leaves not congested, petioles shorter than blades, blades thin, never peltate, flat, fruit longitudinally ribbed ..... *P. pellucida*
1. Leaves rounded, obtuse or acute at base, fleshy, fruit papillose or verrucose, not ribbed ..... 3
  3. Stems glabrous ..... 4
    4. Leaves mostly less than 2 cm long, plant decumbent with erect fertile branches, spikes up to 4 cm long ..... *P. kraemeri*
    4. Leaves 2–4 or more cm long, main stems decumbent only toward base, spikes when well developed 3–6 cm long ..... 5
      5. Leaves tending to be broadest at or below the middle, peduncles of spikes mostly less than 1 cm long ..... *P. mariannensis*
      5. Leaves tending to be broadest above middle, peduncles mostly 1 cm or more long ..... 6
        6. Leaves leathery, pinnately nerved, spikes terminal, 2–3 mm thick, usually more than 7 cm long ..... *P. obtusifolia*
        6. Leaves fleshy, palmately basally nerved, spikes terminal and in upper axils, 2 mm or less thick, usually less than 7 cm long ..... *P. ponapensis*
  3. Stems more or less hairy ..... 7
    7. Rachis of spike at least sparsely hairy, plant puberulent with appressed or incurved short hairs ..... *P. palauensis*
    7. Rachis of spike glabrous, plant variously hairy ..... 8
      8. Stems usually rooting at nodes only near base, tending to be erect, spikes mostly exceeding leaves ..... 9
        9. Plant densely pubescent, leaves all opposite or whorled ..... *P. leptostachya*
        9. Plant sparsely puberulent, at least some leaves usually alternate ..... 10
          10. Leaves mostly broadest below middle, hairs appressed ..... *P. mariannensis* f. *saipana*
          10. Leaves mostly broadest at or above middle, hairs tending to be spreading or merely curved upward ..... 11
            11. Leaves ciliolate only near tip, acute or somewhat attenuate at base, stem prominently hirtellous ..... *P. palauensis* var. *occidentalis*
            11. Leaves ciliolate all around, obtuse to somewhat rounded at base, stem sparsely hirtellous ..... *P. ponapensis* var. *trukensis*
    8. Stems prominently rooting at nodes, decumbent, spikes 1–2 cm long ..... 12
      12. Stems abundantly subappressed hirtellous with short straight hairs, these less than 0.5 mm long, fruit 0.8 mm long ..... *P. breviramula*
      12. Stems pubescent with curved or long straight hairs, fruit 0.4–0.5 mm long ..... 13
        13. Hairs on stem long and straight, pubescence appearing shaggy, leaves broadly elliptic to orbicular ..... *P. kusaiensis*
        13. Hairs on stems curved, pubescence crisp, leaves elliptic-lanceolate ..... *P. glassmanii*

*Peperomia breviramula* C. de Candolle

*Peperomia breviramula* C. de Candolle, Bot. Jahrb., 56:503, 1921 [type from Ponape, Ledermann 13739, not seen by us].—Kanchira, Enum. Micr. Pl., 393, 1935.—Yuncker, Occ. Pap. Bishop Mus., 14:22–23, 1938; 22:107, 1959.—Hosokawa, Trans. Nat. Hist. Soc. Taiwan, 33:120, 1943.

Herb with decumbent to ascending stems, rooting at nodes, abundantly subappressed hirtellous, hairs straight, less than 0.5 mm long; leaves alternate 1–2 cm long, up to 1.6 cm wide, oval-elliptic to sub-ovate or suborbicular, obtuse at both ends or base somewhat obtusish, trinerved from base, white beneath, abundantly ciliate, moderately hirtellous on

both faces when young, becoming glabrate when older, petiole 3–5 mm long, hirtellous; spikes 1–1.8 cm long, pedunculate, terminal or opposite upper leaves, moderately flowered, glabrous; peduncles 5–9 mm long, hirtellous; fruit subglobose, viscid papillose, 0.8 mm long. (Description adapted from Yuncker's (1938) description and figure.)

Endemic to Ponape, known only from the type and one other collection; growing epiphytically in montane forests.

CAROLINE ISLANDS.—Ponape: Nipit, 350 m, *Hatusima* 10858 (FU); Paue, Montesanto, de Candolle, 1921:503 (citing Ledermann 13739, type, not seen by us, probably destroyed). Some material

previously cited as this species is now regarded as belonging to *P. glassmanii*.

***Peperomia caperata* Yuncker**

*Peperomia caperata* Yuncker, Kew Bull., 1957:421, 1958 [type from cultivated material, native home uncertain].

This species was mentioned in a letter from Paul Souder, as growing in Guam, and identified by E. H. Bryan, Jr. We have seen no material. It is a plant with very short stem, erect prominently cordate, usually somewhat peltate, very bullate leaves, which has become common as a house or greenhouse plant in recent years. No circumstances were given as to its occurrence on Guam.

***Peperomia glassmanii* Yuncker**

*Peperomia glassmanii* Yuncker, Occ. Pap. Bishop Mus., 22:105-107, 1959 [type from Ponape, *Glassman* 2844].—Glassman, Bishop Mus. Bull., 209:54, 1952 [pro parte; as *P. palauensis*].

Weak, fleshy, creeping herbs, rooting at lower nodes, stems densely to sparsely puberulent with curved hairs; leaves alternate, well-developed ones elliptic to broadly lanceolate, mostly 0.7-1.5 cm wide, 2-4 cm long, acutish at both ends, 3-5 nerved, nerves from base, outer pair, when 5, weakly developed, blades strongly ciliate, more or less puberulent on both sides, especially on nerves, petiole 3-5 (rarely 10) mm long; spikes pedunculate, terminal and opposite upper leaves, not numerous, 1-1.5 cm long, with peduncles almost as long, peduncle puberulent, rachis glabrous, rather sparsely flowered; fruit about 0.4 mm across, globose ovoid, very few seen.

This species may prove to be too close to *P. breviramula* when that species is better known.

Endemic to Ponape, where it grows as an epiphyte in montane rain forest and cloud forest at middle to high elevations.

GEOGRAPHIC RECORDS AND SPECIMENS EXAMINED

CAROLINE ISLANDS.—Ponape: *Ledermann* 13175 (BISH); *Koidzumi* in January 1915 (TI); Tolomail, *Takamatsu* 986 (BISH); Mt. Tolomail, *Takamatsu* 981 (BISH); Mt. Tolotom, 1200 ft [365 m] *Glassman* 2844 (US, isotype, BISH, type); Mt. Troton, *Hosokawa* 9534 (BISH, A); Mt. Tolenkiup, 500 ft [150

m], *Glassman* 2530 (US, BISH); Mt. Kankauzan, *Hosokawa* 5481 (BISH, A); Mt. Tamatamansakir, 1200 ft [365 m] *Glassman* 2328 (US, BISH); Niinioanii, *Hosokawa* 5701 (A); Tolun Nanket, mountain above Nanipil, drainage of Tawenjokola River, Not District, 600 m (above power plant), *Fosberg* 26423 (US, DPU), *Fosberg* 26434 (US, BISH, Fo, DPU, NY); 500 m, *Fosberg* 26456 (US, BISH, DPU); Mt. Nanalaut, 2000 ft [600 m], rain forest, *Glassman* 2386 (US) (cited by Glassman 1952:54, as *P. breviramula*); Sankaku-Yama, *Kanehira* 756 (NY, FU); Nipit, 400 m, *Hatusima* 10880 (FU); Mt. Seletenreh, U District, *Stone* 5388 (BISH).

*Kanehira* 756, *Glassman* 2328, 2530, 2844 were cited by Glassman (1952) as *P. palauensis* and are the basis for records of that species from Ponape.

***Peperomia kraemeri* C. de Candolle**

*Peperomia kraemeri* C. de Candolle, Bot. Jahrb., 56:503, 1921 [type from Palau, Koror, Kraemer, not seen by us].—Kanehira, Enum. Micr. Pl., 304, 1935.—Yuncker, Occ. Pap. Bishop Mus., 14:12, 1938; 22:99, 1959.

Plant decumbent, rooting at nodes, almost entirely glabrous; leaves oval-ovate, surfaces glabrous or upper sparsely puberulent near base, margins minutely ciliolate near apex, obtuse at base, obtuse or acutish near apex, petioles 3-6 mm long, glabrous; spikes pedunculate, terminal and opposite uppermost leaves, to 3.3 cm long, glabrous; fruit subglobose.

Very close to *P. palauensis*.

Endemic to Palau, where it usually occurs on the volcanic islands.

GEOGRAPHIC RECORDS AND SPECIMENS EXAMINED

CAROLINE ISLANDS.—Palau: Babeldaob: Aimion, in monte Ngarua, *Tuyama* in 1937 (TI); Gatulei-to, Ailai-son, *Hosokawa* 7305 (A, in part). Koror: de Candolle, 1921:503. Ngarakabesang: *Tuyama* in 1939 (TI). Urukthapel: Middle of northeast coast of Magaiald (north arm of Urukthapel Island), southwest shore of Malakal Harbor, 1 m, *Fosberg* 25869 (Fo).

Recorded with doubt from the Marianas by Yuncker, 1938:12-13, but see *P. mariannensis* for this record.



*Peperomia kusaiensis* Hosokawa

*Peperomia kusaiensis* Hosokawa, Trans. Nat. Hist. Soc. Formosa, 25:120, 1935 [type from Kusaie, *Hosokawa 6278*].—Yuncker, Occ. Pap. Bishop Mus., 14:24, 1938; 22:107–108, 1959.

Fleshy decumbent to ascending low herb, rooting at nodes, rather shaggy pubescent with long straightish spreading hairs; leaves alternate, broadly elliptic to broadly oval or orbicular, 1–2 (rarely 2.5) cm long, 1–1.5 cm wide, obtuse to acutish at base and apex, strongly ciliate, sparsely hirsute on both faces, obscurely 3-nerved, petioles 2–5 mm long, pubescent; spikes terminal, 1–2 cm long, sparsely flowered below, on shorter sparsely pilose peduncles; fruits globose, about 0.5 mm diameter.

Very closely related to *P. glassmanii* and *P. breviramula*, differing from both in the character of the pubescence, possibly closer to *P. glassmanii* because of the small fruits. How constant this is in either species is uncertain, as very few fruits are available.

Endemic to Kusaie, where it has only been found growing as an epiphyte on the mossy tree trunks in the cloud forest (*Eugenia-Astronia* forest).

CAROLINE ISLANDS.—Kusaie: *Takamatsu 566* (BISH); Mt. Buache (Matante), *Hosokawa 6278* (type in Herb. Taihoku, not seen, A, isotype); *Hatusima 11180* (FU); *Kanehira 4231* (FU); *Fosberg 26604* (US, BISH, Fo, NY, L, DPU)

*Peperomia leptostachya* Hooker & Arnott

*Peperomia leptostachya* Hooker & Arnott, Bot. Beechey Voy., 96, 1832 [type from the Sandwich Islands, Lay & Collie, not seen by us.].—Yuncker, Occ. Pap. Bishop Mus., 14:22, 1938; 22:104, 1959.

Erect, fleshy, pubescent herb, leaves opposite or whorled, lower ones tending to be reflexed and caducous in dry seasons and situations, oval, oval-ovate, or rarely broadly ovate, obtuse to acutish at both ends, petioles up to 1 cm long, usually shorter; spikes terminal or in upper axils, pedunculate, slender, elongate, to 6 (or 10) cm or more, peduncles hirtellous, rachis glabrous; fruit globose-subobovoid, 0.9 mm long.

Hawaii and Southeastern Polynesia westward at least to Fiji and the New Hebrides; in Micronesia known only from Palau, where it is uncommon on limestone rocks at low elevations.

CAROLINE ISLANDS.—Palau: Koror: On elevated coral rock, *Kanehira & Hatusima 4416* (FU); small unnamed island near Koror, *Kanehira 243* (FU, NY).

*Peperomia mariannensis* C. de Candolle

*Peperomia mariannensis* C. de Candolle, Prodr. 16 (1):442, 1869 [type from "Ins. Mariannis," *Gaudichaud*].—Safford, Contr. U.S. Nat. Herb., 9:348–349, 1905.—Hosokawa, Trans. Nat. Hist. Soc. Formosa, 25:119, 1935.—Bryan, Plants of Guam [unpub., 1946?].—Yuncker, Occ. Pap. Bishop Mus., 14:15–17, 1938; 22:99–100, 1959.—Fosberg, Phytologia, 13:239, 1966.—Stone, Micronesica, 6:244–245, 1971.—Fosberg, Falanruw, and Sachet, Smithsonian Contr. Bot., 22:20, 1975.

Succulent herb, erect to decumbent, or when epiphytic, pendent; leaves alternate or opposite, fully developed ones with blades 2.5–4.5 cm long, 3–5 nerved from base, elliptic to oval-elliptic, acute to obtuse at both ends, strongly punctate beneath, dots dark or obscure, glabrous except for slight ciliation near apex, petiole 2–9 (rarely 12) mm long; spikes pedunculate, terminal, opposite upper leaves, or rarely in upper axils, well-developed ones 4–8 cm long, sparsely flowered near base, basal portions fruiting when apical parts are in anthesis or bud; stigmas pubescent; fruit depressed, globose, papillate.

The type, collected in the Marianas by Gaudichaud, was in the Berlin herbarium and was doubtless lost in the bombing of this herbarium during World War II. A drawing of it in the Geneva Herbarium shows mostly opposite leaves with blades ovate, the larger ones rather acutish, the smaller definitely obtuse. "Coll. Gaudichaud. h. Berol." A specimen in Paris, "Iles Mariannes," *Gaudichaud 216* might be a duplicate of the type.

*Peperomia guamana* has always been maintained as a separate species from *P. mariannensis*, and several other species have been described from the Marianas population of *Peperomia*. Individuals have also been referred to species from other areas, such as *P. membranacea* Hooker & Arnott, *P. kraemeri* C. de Candolle, *P. pellucidopunctulata* C. de Candolle. There is certainly a considerable range of variation in a number of characters, but there seems to be little correlation between these variations. This has been discussed elsewhere (Fosberg, 1966:239) with the conclusion that only one native species is represented in the Marianas. Its



correct name is *P. mariannensis* C. de Candolle.

The occasional plants of this species with hirtellous stems were placed in a separate variety by Yuncker. Although such plants seem to be more frequent in Saipan, and possibly also occur on Tinian, the glabrous form is also there, indicating that the hirtellous plants probably do not form a separate population, but rather a sporadically occurring form. Since the difference is only slight, it seemed best to reduce var. *saipana* to the rank of *forma*.

As Yuncker has pointed out, plants of this species from the Northern Marianas tend to be larger in stature than those from Guam. However, this is only a tendency and is correlated with nothing else. We agree with Yuncker in not regarding it as meriting taxonomic recognition. One of these speci-

mens, *Falanruw* 1923, from Alamagan, has the more obovate leaves and longer peduncles of *P. ponapensis*. We prefer, until the Alamagan population can be studied critically in the field, to regard this as an aberrant individual of *P. mariannensis*.

Distinction from *P. kraemeri* is a more difficult problem. About the only distinctions seem to be the smaller generally obtuse leaves and shorter spikes of *P. kraemeri*. However, we have had little chance to study the glabrous Palau material referred here. It seems also very close to *P. palauensis*, so that reduction might require bringing the latter in, too. For the present these may be regarded as three very closely related species. Plants from Palau referred by Yuncker to *P. guamana* seem to fit in *P. kraemeri* with no difficulty and are so disposed of here.

Endemic in the Marianas, where two forms are known.

### Key to Forms of *Peperomia mariannensis*

Stems glabrous .....	f. <i>mariannensis</i>
Stems sparsely hirtellous .....	f. <i>saipana</i>

#### *Peperomia mariannensis* C. de Candolle f. *mariannensis*

*Peperomia mariannensis* C. de Candolle in de Candolle, Prodr., 16(1):442, 1869.

*Peperomia membranacea* sensu Miquel, Syst. Pip., 120, 1843 [non Hooker & Arnott, Bot. Beechey's Voy. 91, 1841 (1832)].

*Peperomia pellucidopunctulata* sensu von Prowazek, Deutschen Marianen, 66-115, 1913 [non Elmer, Leaff. Phil Bot., 3:760, 1910].

*Peperomia guamana* C. de Candolle in Merrill, Phil. Jour. Sci. Bot., 9:72, 1914 [type from Guam, McGregor 629].—Kanehira, Enum. Micr. Pl., 303, 1935.—Hosokawa, Trans. Nat. Hist. Soc. Formosa, 25:119-121, 1935.—Yuncker, Occ. Pap. Bishop Mus., 14:13, 1938; 22:99-101, 1959.—Bryan, Plants of Guam [unpub., 1946?].

*Peperomia hoeferi* C. de Candolle, Bot. Jahrb., 56:505, 1921 [type from Saipan, Höfer 38, not seen by us].—Kanehira, Enum. Micr. Pl., 303-304, 1935.

*Peperomia mariannensis* Hosokawa, Trans. Nat. Hist. Soc. Formosa, 25:120-121, 1935 [type from Tinian, Hosokawa 7784, not seen by us] [non C. de Candolle, 1869, based on different type].

*Peperomia tinianensis* Hosokawa, Trans. Nat. Hist. Soc. Formosa, 25:121, 1935 [in syn.].

*Peperomia ladronica* Hosokawa, Trans. Nat. Hist. Formosa, 25:268, 1935 [nom. nov. for *P. mariannensis* Hosokawa, non C. de Candolle].

*Peperomia kraemeri* sensu Hosokawa, Trans. Nat. Hist. Soc. Formosa, 25:121, 1935 [non C. de Candolle, 1921].

Stems entirely glabrous.

Plants from the Marianas referred to *P. kraemeri* C. de Candolle by Hosokawa (1935:121) and Yuncker (1938:12-13) do not differ in any essential respect from *P. mariannensis* as here circumscribed and are now referred to that species. Likewise, of the Palau specimens annotated in 1955 as *P. guamana* by Yuncker (1959), the glabrous ones are referred to *P. kraemeri* and those with appressed hirtellous stems and leaves are *P. palauensis* C. de Candolle.

USES.—Used against furry tongue; also against fever (Marianas: Fritz acc. von Prowazek, 1913:66).

VERNACULAR NAMES.—

podpod (Marianas: Fritz acc. von Prowazek, 1913:66)

podputput (Marianas: von Prowazek, 1913)

popudpod (Marianas: Fritz acc. von Prowazek, 1913:66)

potpot (Marianas: von Prowazek, 1913)

put pu put (Alamagan, *Falanruw* 1923)

potpot (Saipan: Kanehira, 1935)

potpotpot (Saipan: Höfer in de Candolle, 1921)

podpod palauan (Guam: *Costenoble* 1196, Merrill, 1914)

porporput (Guam fide A. Taitano, *Evans* 1588)

potpupot (Guam: *Whiting* XI)

pot puput (Guam: *Fosberg* 35516)

## GEOGRAPHIC RECORDS AND SPECIMENS EXAMINED

MARIANAS ISLANDS.—Miquel, 1843:120 (Gaudichaud specimen as *P. membranacea* Hooker & Arnott); von Prowazek, 1913:115 (as *P. pellucidopunctulata* C. de Candolle); Yuncker, 1959:99–100 (“collected by Gaudichaud in the Mariana Islands”); s.l. *Gaudichaud* 216 (P).

Agrigan: Canyon on east side, *Fosberg* 31621 (US, BISH, Fo, NY, DPU).

Pagan: *Hosokawa* 7987 (A).

Alamagan: *Hosokawa* 9908 (BISH, A); Partido village, *Fosberg* 31678 (US, BISH, Fo, DPU); *Anderson* 408 (US, BISH, Fo, NY, DPU, L); *Fosberg* 31674 (US, BISH, Fo, NY, DPU); trail from south-southwest coast, 1025 ft [310 m], *Falanruw* 1923 (US).

Sarigan (Saligan, Sariguan): *Kanehira* 2171 (NY, FU); forest above village, 250–300 m, *Evans* 2381 (US, BISH, Fo, NY); near anchorage, northwest coast, 700 ft [210 m], *Falanruw* 1797 (US), 325 ft [100 m], *Falanruw* 1746 (US).

Saipan: *Kanehira* 986 (NY, FU); s. coll. s.n. (TI); *Tuyama* in 1937 (TI); “Papeng, Saipan,” *Hosokawa* 8023 (in part) (BISH); Charlan-Tarhoho, 200 ft [60 m], *Hosaka* 3008 (US, BISH, Fo, DPU).

Tinian: *Hosokawa* 7823 (BISH); *Tuyama* in 1937 (TI); “in a primary forest near Lion-rock,” *Hosokawa* 7784 (type of *P. mariannensis* Hosokawa, Herb. Taihoku Imp. Univ., not seen) (*Hosokawa*, 1935:120–121).

Agiguan: Yuncker, 1959:100; north end, *Kondo* in 1952 (BISH).

Rota: *Necker* R71 (US); Yuncker, 1959:100; sabana, 1600 ft [490 m], *Stone* 5198 (UG); Mt. Kokoa near Tatacho, *Hosokawa* 7665 (BISH, A); middle-level plateau above Tatacho Point, 150–250 m, *Evans* 2054 (US, BISH, Fo, K, L, MO).

Guam: *Nelson* 13 (US); *Costenoble* 1196 (US); Merrill, 1914:72 (citing R. C. McGregor 629); Ritidian Point, 400 ft [120 m], *Hosaka* 3093 (US, BISH, Fo, NY, L, DPU), 180 m, *Bryan* 1174 (BISH), 50–150 m, *Bryan* 1156 (BISH); Ritidian Point Plateau, *Stone* 4713 (US, UG); Tarague Beach, 10 m, *Anderson* 248 (US); Upi (northeast point) 175 m, *Bryan* 1265 (BISH); Anao, ENE Mt. Santa Rosa, 140 m, *Fosberg* 35516 (US, BISH, Fo, NY, L, DPU); above Anao Point, *Moran* 4540 (US, BISH, NY); southwest of Anao Point, 200 m, *Fosberg* 31939 (US); northeast of College of Guam, *Pedrus* 70

(BISH); above Pago Bay, north of College of Guam campus, *Stone* 4136 (US, UG), *Stone* 4406 (BISH, UG); one mile east of Barrigada, coral shaded by trees, 400–600 ft [120–180 m], *Moore* 48 (US); north end of Tumon Bay area, 5–100 ft [1.5–30 m], *Moore* 395 (US); Machanao Distr., 110 m, *Bryan* 1187 (BISH, FU); Talofoto Point, 90 m, *Bryan* 1116 (BISH, NY); on rock on north side of Talofoto Valley, ½ mile [0.8 km] from sea, 10 m, *Bryan* 1644 (US, BISH); near Talofoto River, *Rodin* 695 (US); Asanite Bay, Talofoto, 25 m, *Evans* 1881 (US, UH, Fo, K, NY, BRI); Lujuna, just off Route 15, 10–15 m, *Evans* 1588 (US, UH, Fo, K) (stems microscopically puberulent); along the Piti-Agat road, *McGregor* 629 (G, type, US, isotype of *P. guamana*); Mt. Lamlam, 400 m, *Anderson* 145 (US, BISH, Fo, NY, DPU), near summit, *Anderson* 334 (US, BISH, Fo, DPU); ridge south of Mt. Lamlam, 385 m, *Fosberg* 35336 (US); Chalandao Mt., 1 km southeast of Jumujong Manglo Mt., 320 m, *Fosberg* 35377 (US); Umatac, *Whiting* XI (US).

*Peperomia mariannensis* f. *saipana*  
(C. de Candolle) Fosberg

*Peperomia mariannensis* f. *saipana* (C. de Candolle) Fosberg, *Phytologia*, 13:240, 1966.—*Stone*, *Micronesica*, 6:245, 1971. *Peperomia saipana* C. de Candolle in Merrill, *Phil. Jour. Sci. Bot.*, 9:72, 1914 [described again as new by C. de Candolle, *Bot. Jahrb.*, 56:505–506, 1921, same type cited; type from Saipan, Fritz in 1903, not seen by us, presumably destroyed in the bombing of the Berlin Herbarium].—*Kanehira*, *Enum. Micr. Pl.*, 304, 1935.

*Peperomia pacifica* Hosokawa, *Trans. Nat. Hist. Soc. Formosa*, 25:119, 1935 [type from Saipan, *Hosokawa* 6654, not seen by us] [non Nakai, *Bot. Mag. Tokyo*, 36:128, 1922].

*Peperomia pacificicola* Hosokawa, *Jour. Jap. Bot.*, 13(3):63, 1937 [new name for *P. pacifica*].

*Peperomia guamana* var. *saipana* (C. de Candolle) Yuncker, *Occ. Pap. Bishop Mus.*, 14(2):15, 1938, 22:101–102, 1959.

Stems sparsely hirtellous.

USES.—Medicinally against headache and coated tongue (Merrill, C. de Candolle, both quoting Fritz).

VERNACULAR NAMES.—

popudpod (Saipan: Kanehira, 1935)

popudpud (Saipan: Merrill, 1914; C. de Candolle, 1921)

## GEOGRAPHIC RECORDS AND SPECIMENS EXAMINED

MARIANAS ISLANDS.—Saipan: *Hosokawa* 8023 (in



part) (A); *Kanehira & Hatusima 4319* (FU); *Kanehira 3569* (FU); C. de Candolle in Merrill, 1914:72 (as *P. saipana*, citing Fritz (Herb. Berol.), type, not seen, probably destroyed); Hosokawa, 1935:119, citing Hosokawa 6654 (type of *P. pacifica* Hosokawa, non Nakai, in Herb. Taihoku Imp. Univ.), 6632, 6663 (none of these seen by us); Yuncker, 1938:15 and 1959:101–102 (as *P. guamana* var. *saipana*).

Tinian: *Okatani 54* (FU).

The type, Fritz in 1903, was presumably destroyed in the bombing of the Berlin Herbarium. The Arnold sheet of *Hosokawa 8023* is somewhat hirtellous and goes here. The sheet in the Bishop Museum is glabrous and is referred to f. *mariannensis*.

### *Peperomia obtusifolia* (L.) A. Dietrich

*Peperomia obtusifolia* (L.) A. Dietrich in L., Sp. Pl., ed. 6, 1:154, 1831.

*Piper obtusifolium* L., Sp. Pl., 30, 1753.

Fleshy glabrous herb with ascending glabrous stems; alternate obovate petiolate leaves, rounded at apex, contracted or cuneate at base, blades to  $6 \times 4$  cm or larger, petiole to 3 cm, spikes terminal, solitary or paired, pedunculate, to 15 cm long or more, fruit ellipsoidal, beaked, beak tending to be hooked.

A form with broad leaves and beak of fruit only curved, is often separated as *P. magnoliaefolia* (Jacquin) A. Dietrich. Micronesian material seen is sterile. The Rota plant could be this, but the two are here not separated as species.

MARIANAS ISLANDS.—Rota: Songsong village, planted, 5–10 m, *Evans 2261* (US).

Guam: In pot, 1963, seen by Fosberg but not collected.

MARSHALL ISLANDS.—Likiep Atoll: Likiep I. planted in pot, *Fosberg 36724* (US).

### *Peperomia palauensis* C. de Candolle

*Peperomia palauensis* C. de Candolle, Bot. Jahrb., 56:505, 1921 [type from Palau, Koror, *Ledermann 14102*].—*Kanehira*, Enum. Micr. Pl., 304, 1935.—*Yuncker*, Occ. Pap. Bishop Mus., 14:20–21, 1938; 22:104–105, 1959.—*Glassman*, Bishop Mus. Bull., 209:54, 1952.

Decumbent fleshy plant, rooting at nodes, stems moderately to closely appressed puberulent, rarely more prominently hairy; leaves mostly alternate,

oval to obovate, apex obtuse to acutish, base mostly obtuse, blade 2–4 cm long, sparingly puberulent below, obscurely so above, rarely prominently so on both faces (*Stone 4552*), petiole 3–7 mm long; spikes pedunculate terminal and opposite upper leaves, up to 7 cm long, peduncle to 1 cm, puberulent, rachis obscurely puberulent or glabrous; fruit globose or subglobose, 0.8 mm long.

The type was collected on “Koror, bei 10–100 m ü.M., auf Kalkfelsen (*Ledermann n. 14102*)” in 1914. No mention was made of where it was deposited, but it was doubtless lost in the bombing of Berlin in World War II. A fragment in the de Candolle Herbarium, Geneva, has 2 leaves, a piece of stem, and a part of a spike. The leaves are oval, slightly acuminate, very minutely appressed puberulent and finely brown punctulate, especially beneath, ciliate toward apex; petiole and stem strongly appressed pubescent; the spike has the rachis only very slightly puberulent.

### *Peperomia palauensis* C. de Candolle var. *palauensis*

Stems appressed puberulent, leaves broadly ovate, usually obtuse at base, rachis of spike puberulent, rarely glabrous or almost so.

Probably endemic to Palau, found commonly on limestone islands. Reported from Saipan but these records are here assigned to *P. mariannensis*. Reported also from Ponape, but Ponape records are assigned to *P. glassmanii*. Yuncker (1959:104) refers *Kanehira 4644* to *P. leptostachya*, but the appressed pubescence suggests *P. palauensis*.

#### GEOGRAPHIC RECORDS AND SPECIMENS EXAMINED

CAROLINE ISLANDS.—Palau: *Koidzumi* in 1915 (TI); *Todaiyama, Kanehira 4644* (FU); *Makarakol, Hosokawa 9235* (A). *Babeldaob*: *Arumizu, Hosokawa 9083* (A); *Gatulel-tô, Ailai-son, Hosokawa 7305* (A, part). *Koror*: *Tuyama* in 1939 (TI); C. de Candolle, 1921:505 (citing *Ledermann 14102*, type, fragment in G seen by us); *Armijt, Tuyama* in 1939 (TI); in insulis in *Sinu Iwayama, Tuyama* in 1939 (TI). *Aulupse’el* (*Oropusyakaru-tô, Aurapushekaru*): *Aulupse’el I.*, just south of Koror, south side, *Maluker Bay, Risong*, 2 m, *Fosberg 47566* (US, BISH); *Du’ebachel Beach*, 10 m, *Evans 586* (US, UH, Fo) (unusually densely pubescent); *Hosokawa*



7465 (BISH, A), 9112 (BISH, A); northwest end of island, just south of Koror, *Stone 4552* (UG). Urukthapel: Magaiald (north arm of Urukthapel I.), southwest shore of Malakal Harbor, 1 m, *Fosberg 25869a* (Fo); west peninsula, *Fosberg 32210a* (US). Ngeanges (Gaiangas): west of southern point of Urukthapel, 2–25 m, *Fosberg 25843* (US, BISH, Fo, NY, L, DPU). Eil Malk: Makarakaru, *Tuyama* in 1937 (TI).

The puberulence on the rachis of the spike seems to be almost always present, but *Fosberg 32210a*, in other respects this species, seems to lack it.

***Peperomia palauensis* var. *occidentalis***

**Fosberg, new variety**

Caulis prostratus, ramis erectis, conspicue puberulis trichomatibus non valde adpressis, spicarum rachibus glabris.

Main stem prostrate, rooting at nodes, leafy branches erect, stems prominently hirtellous with spreading to somewhat inwardly curving hairs, leaves broadest at middle or distally, ciliolate only toward the obtuse to acutish apex, acute at base, petiole to 10 mm long; spikes with hirtellous peduncle, glabrous rachis, not very densely floriferous, quite sparsely so toward base.

Characterized by spreading to somewhat incurved hairs on stems, leaves acute at base, petioles 6–10 mm long; sparsely flowered glabrous or almost glabrous spikes.

VERNACULAR NAMES.—

Rumriuwafathu (Sonsorol: *Berry 18*)

rterül (Palau: *Salsedo 40*)

CAROLINE ISLANDS.—Palau: Koror: Limestone rock island in Iwayama Bay, *Salsedo 40* (US); Ngarmid, 30 m, *Fosberg 42486* (US, UH, Fo, K, MO, L).

Sonsorol I.: Northern part, on rocks, *Berry 18* (US, type).

***Peperomia pellucida* (L.) Humboldt,**

**Bonpland, & Kunth**

*Peperomia pellucida* (L.) Humboldt, Bonpland, & Kunth, Nov. Gen. et Sp. Pl., 1:64, 1815.—Merrill, Phil. Jour. Sci. Bot., 9:72, 1914.—Hosokawa, Trans. Nat. Hist. Soc. Formosa, 25:119, 1935.—Kanehira, Enum. Micr. Pl., 304, 1935.—Yuncker, Occ. Pap. Bishop Mus., 14:9–10, 1938; 22:97–98, 1959.—Tuyama, Kagaku Nanyô 4:16, 1941.—Bryan, Plants of Guam [unpub., 1946?].—Glassman, Bishop

Mus. Bull., 209:54, 1952.—Stone, Micronesica, 6:245, 1971. *Piper pellucidum* L., Sp. Pl., 30, 1753 [type from “America calidiore”].

*Peperomia bilineata* sensu Volken, Bot. Jahrb., 31:401, 1901 [non (Blume) Miquel, Nova Acta Acad. Nat. Cur., 19 (Suppl. 1):485, 1843].

*Peperomia pellucida* var. *obtusifolia* Koidzumi, Bot. Mag. Tokyo, 29:248, 1915 [nom. nud.].

*Peperomia yapensis* C. de Candolle, Bot. Jahrb., 56:504, 1921 [type from Yap, Volken 342, not seen by us].—Hosokawa, Trans. Nat. Hist. Soc. Formosa, 25:119, 1935.—Kanehira, Enum. Micr. Pl., 304, 1935.—Hosokawa, Jour. Jap. Bot., 13:201, 1937; Bull. Biogeogr. Soc. Jap., 7:188, 1937b.

*Piper bilineata* Miquel ex Kanehira, Enum. Micr. Pl., 305, 1935 [in syn.; error by Kanehira].

*Peperomia lineata* Miquel ex Yuncker, Occ. Pap. Bishop Mus., 22:99, 1959 [probably an error by Yuncker for *P. bilineata* Miquel].

Slender erect glabrous, stems translucent; leaves thin, cordate, mostly opposite, strongly nerved, on slender petioles; spikes pedunculate, terminal and in upper axils, elongate, strongly exceeding leaves; fruits longitudinally ribbed.

Native of tropical America, but widely introduced in the Old World tropics; in Micronesia in Guam, the high, and a few low, islands of the Carolines, and Jaluit in the Marshalls. On mossy rocks, moist soil, and the bases of coconut trees, mainly in lowlands, common around villages and in plantations, disturbed shaded places.

VERNACULAR NAMES.—

podpod lahe (Guam: *Costenoble 1197*)

rtertil (Palau: *Tuyama*, 1941, citing A. Krämer)

rtertiel (Palau, Babeldaob I.: *Fosberg 32446*)

makel ni pan (Yap: *Falanruw 755*)

rafung (Yap: *Wong 318*)

rum (Sonsorol: *Berry 20*)

pukuson (Truk: *Wong 178*)

opul kongkong (Eauripik: *Fosberg 47128*)

USES.—In Sonsorol the plant is pounded and the juices are used on cuts, *Berry 20*.

**GEOGRAPHIC RECORDS AND SPECIMENS EXAMINED**

MICRONESIA.—*Kamiya Shinsaburo* (*Matsutaka*) 132 (TI).

MARIANAS ISLANDS.—Guam: *Costenoble 1197* (US); *G.E.S. 234* (US, BM, NY); Merrill, 1914:72; Agaña, *Seale* in 1900 (BISH).

CAROLINE ISLANDS.—Palau: *Kanehira & Nisida 3* (FU); *Yamada* in 1925 (TI); *G. Koidzumi* in 1915 (TI); *Akoru-kaigan*, *Hosokawa 7101* (BISH, A); *Arukoron-son*, *Konrai*, *Hosokawa 7082* (BISH, A)

(both cited by Hosokawa, 1937a: 201 as *P. yapensis*). Babeldaob (Babeltaob, Babelthuap): *Koidzumi* in 1915 (TI); Aimirilik, *Tuyama* in 1937 (TI); west coast of island, Ngeremetengel, in village on bare rocks near stream, 1 m, *Fosberg 32446* (US, BISH); Molegojok (Meligeok), *Tuyama* in 1939 (TI); Ngarsul, *Tuyama* in 1937 (TI); Aimion, *Tuyama* in 1937 (TI); Ngial, *Hosaka 3384* (US, BISH, DPU). Koror: Yuncker, 1938:9–10. Angaur: 25 m, *Fosberg 25910* (US, BISH, Fo, DPU, NY); *Koidzumi s.n.* in 1915 (TI); *s. coll. s.n.* in 1930 (TI); *s. coll. s.n.* (TI).

Sonsorol: Village area along the tracks, *Berry 20* (US).

Yap: *Wong 318* (US, BISH, Fo, NY, L, DPU); *Kanehira & Hatusima 4327* (FU); *Kamiya?* *s.n.* (TI); Volkens, 1901:401 (citing Volkens 312 as *P. bilineata*); de Candolle, 1921:504 (citing Volkens 342 as type of *P. yapensis*); Mabo, *Hosokawa 8824* (Fo); Tomil I., 100 ft [30 m], *Hosaka 3257* (US, BISH); in oppido Dogol, *Tuyama* in 1939 (TI), *Tuyama 7217* (UG); Kanif, *Takamatsu 1910* (BISH); near Catholic Mission, *Blackburn 243* (US); Balabat, 50 ft [15 m], *Falanruw 755* (US); Tabunfi village, southeast Yap, 5 m, *Cushing & Mitag 553a* (US, UH); Ma'lai Village, Mun. Kani-fay, 3 m, *Fosberg 46343* (US, Fo).

Eauripik: Eauripik Islet, 1–2 m, *Fosberg & Evans 47128* (Fo).

Truk: 6 ft [2 m], *Wong 178* (US, Fo, BISH). Dublon: 50 ft [15 m], *Hosaka 2758* (US, BISH, Fo, NY, L, DPU). Tol: Hosokawa, 1937a:201, and 1937b: 188 (citing Hosokawa 8305 as *P. yapensis*); Amatyan (Amatang), *Hosokawa 8305* (BISH).

Ponape: Colonia, *Hatusima 10740* (FU); vicinity of Colonia, shade of banana tree, *Glassman 2584* (US, BISH); Not District, Colonia, *Wong 60* (US, BISH, Fo, NY, L, DPU); Net village, *Salomon & George 49* (US).

Kusaie: Hosokawa, 1937a:201 (citing Hosokawa 6460 as *P. yapensis*); Lele, *Hosokawa 6460* (A), *Takamatsu 332* (BISH); Lele Islet, *Glassman 2709* (US, BISH), 15 m, *Wong 79* (US, BISH, Fo, NY, DPU), 1–5 m, *Fosberg 26552* (US, BISH, Fo, NY, DPU).

MARSHALL ISLANDS.—Jaluit: *Koidzumi* in 1915 (TI); *Koidzumi*, 1915:248 (as var. *obtusifolia*).

### *Peperomia ponapensis* C. de Candolle

*Peperomia ponapensis* C. de Candolle, Bot. Jahrb., 56:504,

1921.—Kanehira, Enum. Micr. Pl., 304, 1935.—Hosokawa, Trans. Nat. Hist. Soc. Formosa, 25:119, 1935; Jour. Jap. Bot., 13:200, 1937a; Kudoa, 5:95, 1937b.—Yuncker, Occ. Pap. Bishop Mus., 14:17, 1938; 22:102–103, 1959.—St. John, Pac. Sci., 2:108, 1948.—Glassman, Bishop Mus. Bull., 209:54, 1952.—Fosberg, Atoll Res. Bull., 39:7, 1955 [as *Peperomia* sp.]; Phytologia, 13:240–241, 1966.—Stone, Micronesica, 1:155, 1964 [as *Peperomia*].

Herb up to 40 cm tall, leaves and branching opposite and alternate, usually on same plant, where alternate with a tendency to an appearance of a branch opposite to a leaf, though this may be merely a matter of the original shoot being crowded aside by an axillary branch, often with a leaf-scar opposite an apparently alternate leaf; leaf blades broadly elliptic to obovate, up to 3.5 cm wide and 5.5 cm long, 5 or 3 nerved, when 5, the outer pair weaker, all originating at base, apex obtuse to bluntly acute or slightly acuminate, petiole up to 15 mm long, lower leaves often reduced and tending to be orbicular; spikes pedunculate, terminal and in upper axils of opposite leaves, leaf-opposed to alternate leaves, with some tendency to panicle arrangement, up to 7 cm long, more loosely flowered toward base, some tendency toward earlier flowering at base of spike; fruit globose, notably papillate-glandular.

This species is here given a much broader circumscription than by previous authors. The reduction of *P. volkensii* C. de Candolle, *P. gibbonsii* C. de Candolle, and *P. trukensis* Yuncker has been discussed elsewhere (Fosberg, 1966). Since that paper was published, we have examined a fragment of the type of *P. gibbonsii* in the de Candolle Herbarium at Geneva (*Gibbons 1072*). It is a single spike with several immature and mature fruits. The latter are globose. Several stigmas are bifid, the character on which *P. gibbonsii* was founded. Other stigmas appear entire, but these are very poorly developed. Our conclusions as to uniting this species with *P. ponapensis* remain unchanged.

Also at Geneva we examined a fragment of *Ledermann 13986*, from Ponape. This is not the type of *P. ponapensis*, nor was it cited with the original description, but it was so named by C. de Candolle. It appears to be this species as usually understood, with alternate, slightly obovate acutish leaves.

We have not seen authentic material of *P. volkensii* C. de Candolle, which was based on Volkens



2 from Kusaie and Finsch 1 from Ebon, Marshall Islands, but we have material from the exact type-locality, Lele Islet Kusaie, *Fosberg* 26538, which agrees well with this species. We consider that Yuncker (1959) by stating that *P. volkensis* is endemic to Kusaie has effectively lectotyped it.

Endemic to the eastern Carolines—Truk, Ponape, Pingelap, and Kusaie—and the central to southern Marshalls—Lae, Ailinglapalap, Arno, Jaluit, and

Ebon atolls. The records from the Marianas admitted by Yuncker are here referred to the very similar *P. mariannensis* C. de Candolle. A specimen from Alamagan, Northern Marianas, *Falanruw* 1923, keys to this species and was referred there at first by us. On reconsideration, however, it could be an aberrant individual of *P. mariannensis* and is cited under that species. Two varieties may be distinguished.

### Key to Varieties of *Peperomia ponapensis*

- Stems completely glabrous ..... var. *ponapensis*  
 Stems more or less subappressed hirtellous ..... var. *trukensis*

#### *Peperomia ponapensis* C. de Candolle var. *ponapensis*

*Peperomia ponapensis* C. de Candolle, Bot. Jahrb., 56:504–505, 1921 [type from Ponape, Ledermann 13914, not seen by us].—Stone, Micronesica, 1:155, 1964.

*Peperomia pallida* sensu Schumann, Bot. Jahrb., 9:198, 1888 [non (Forster f.) A. Dietrich, Spec. Pl., ed. 6, 1:153, 1831]. *Peperomia gibbonsii* C. de Candolle, Bot. Jahrb., 56:504, 1921 [type from Marshall Is., Ailinglapalap, *Gibbons* 1072].—Kanehira, Enum. Micr. Pl., 303, 1935.—Hosokawa, Trans. Nat. Hist. Soc. Formosa, 25:119, 1935.—Yuncker, Occ. Pap. Bishop Mus., 14:10–12, 1938; 22:104, 1959.—Fosberg, Phytologia, 13:241, 1966.

*Peperomia volkensis* C. de Candolle, Bot. Jahrb., 56:503, 1921 [type from Kusaie, Volkens 2, not seen by us].—Kanehira, Enum. Micr. Pl., 304, 1935.—Hosokawa, Trans. Nat. Hist. Soc. Formosa, 25:119, 1935.—Yuncker, Occ. Pap. Bishop Mus., 14:17, 1938; 22:102, 1959.—Fosberg, Phytologia 13:240–241, 1966.

Endemic to the Eastern Caroline and Marshall islands. Found mainly at very low elevations, growing on limestone and basalt rocks, frequently on walls of ruins.

USES.—“The plants are used medicinally” (Yuncker, 1959:22:103).

#### VERNACULAR NAMES.—

warin (Pingelap: *St. John* 21475, *Glassman* 2650)  
 rabikiaga (Lae: *Fosberg* 34027)  
 rapisrage (Ailinglapalap: de Candolle, 1921:504; *Gibbons* 1072)  
 drebijdreke = holding rocks (Arno: *Stone* 1082, *Anderson* 3745, *Hatheway* 849)  
 rebijrege (Jaluit: *Fosberg* 26734)

#### GEOGRAPHIC RECORDS AND SPECIMENS EXAMINED

CAROLINE ISLANDS.—Ponape: s.l. *Ledermann* 13986 (G); de Candolle, 1921:504–505 (citing Leder-

mann 13914, from Matalanim, type, not seen by us); Matalanim District, Sabera, *Glassman* 2760? (US); Nanmatol I., *Fosberg* 26379 (US, BISH, Fo, NY, L, DPU), 1–3 m, *Fosberg* 26377 (US, BISH, Fo, NY, DPU); Nanmatol ruins, Matalanim, *Hatusima* 11124 (FU), *Kanehira* 858 (FU); Jokaazi Rock, near Kolonia, *Hatusima* 10976 (FU), 10977 (NY).

Pingelap: On coral stone wall in moist forest, near lagoon beach, *St. John* 21475 (US, BISH); Pingelap I., *Glassman* 2650 (US, BISH).

Kusaie: *Kamiya* 267 (TI); de Candolle, 1921:503, Yuncker 1938:17, 1959:102 (all as *P. volkensis*, citing Volkens 2, type from Lele I., not seen by us); Lele I., 1–5 m, *Fosberg* 26538 (US, BISH, Fo, NY, L, DPU); Rero-Taonsak, *Hosokawa* 6177 (A), near Maarem, 200 m, *Hatusima* 11144 (FU).

MARSHALL ISLANDS.—Lae: Lae I., very rare, one colony on rocks in *Barringtonia* forest, *Fosberg* 34027 (US, BISH, Fo, NY, L, DPU).

Ailinglapalap: de Candolle, 1921:504, Yuncker, 1938:10–12, 1959:104 (all as *P. gibbonsii*, citing *Gibbons* 1072, type); *Gibbons* 1072 (G), fragment seen by us.

Arno: West side Taklepeg I. (E. Taklep), *Stone* 1032 (Fo); Kijbwe I., *Anderson* 3745 (US, BISH, Fo, NY, L, DPU); Arno I., *Hatheway* 791 (US, BISH, Fo, NY, L); Takleb Ej I., *Hatheway* 849 (US, BISH, Fo, NY, L).

Mili: Stone, 1964:155, casual record, probably this species.

Jaluit: Imruj (Imrodj) I., *Fosberg* 26734 (US, BISH, Fo, NY, L, DPU).

Ebon (Boston): Schumann, 1888:198 (as *P. pallida*, citing a Finsch specimen not seen by us);



de Candolle, 1921:503; Kanehira 1935:304 (both as *P. volkensii*, citing Finsch n.l., not seen by us).

***Peperomia ponapensis* var. *trukensis*  
(Yuncker) Fosberg**

*Peperomia ponapensis* var. *trukensis* (Yuncker) Fosberg, Phytologia 13:241, 1966 [type from Truk, Tol I., Takamatsu 21].—Hosokawa, Jour. Jap. Bot., 13:200–201, 1937a; Bull. Biogeogr. Soc. Jap. 7:188, 1937b [both as *P. ponapensis* C. de Candolle].

*Peperomia trukensis* Yuncker, Occ. Pap. Bishop Mus., 14:23–24, 1938; 22:108, 1959.

Stems, petioles, leaf blades and peduncles more or less subappressed hirtellous, blades ciliate almost all around.

Some specimens, such as *Fosberg 24550*, are so densely hirtellous that they could be mistaken for *P. palauensis*, but the rachis is glabrous.

Found in Truk and rarely on Ponape, on rocks at low to middle altitudes.

**GEOGRAPHIC RECORDS AND SPECIMENS EXAMINED**

CAROLINE ISLANDS.—Truk: Yuncker, 1938:23–24, 1959:108; Hosokawa 1937a:201, 1937b:188 (all as *P. trukensis*). Moen (Wara): Wara Mt., Tukiman, Hosokawa 8473 (BISH, A). Dublon (Natusima): Hosokawa 8360 (US, BISH, A); upper ridges and top of Mt. Tolomen (Tolowan), 200–360 m, *Fos-*

*berg 24550* (US, BISH, Fo, DPU). Tol: s.l., Stone 5336 (BISH); Suyoto, Takamatsu 21 (BISH, type); Uriribot, Hosokawa 8283 (BISH, A); 8251 (BISH, A).

Ponape: Yuncker, 1959:108 (as *P. trukensis*); Jokaj (Gyokazi, Jokaazi), Hosokawa 6054 (BISH, A); Hatusima 10977, part (FU).

***Piper* L.**

*Piper* L., Gen. Pl., ed. 5, 18, 1754 [=1753].

Chavica Miquel, Syst. Pip., 222, 1843.

Macropiper Miquel, Comment. Phytogr. 35, 1840.

Shrubs or climbers, mostly aromatic, with alternate, simple, frequently stipulate leaves with expanded bases, scars extending around nodes; spikes or racemes axillary or leaf-opposed (may be paniculate or umbellate outside Micronesia); flowers bisexual or unisexual and then often dioecious, surrounded by 3 scale-like or peltate bracts, these separate or connate; stamens several; stigmas 2–4 or more, fruit a fleshy drupe, often immersed in the swollen fleshy rachis or connate with the bracts.

Pantropical, a few species in Micronesia. Common shrubs in undergrowth and small openings in forest, or climbing on tree trunks and creeping on ground. Several species are of economic importance, including the black pepper of commerce, cubebs, and the betel pepper.

**Key to Micronesian Species of *Piper***

1. Shrub with axillary spikes .....2
2. Spike 1 in an axil .....*P. guahamense*
2. Spikes usually 2–5 in an axil .....*P. latifolium*
1. Climbers, or shrubs with leaf-opposed spikes .....3
3. Leaves with one of the pairs of principal nerves arising well above base, climbers .....4
4. Leaves with one strong pair of nerves arising slightly above base, usually a pair of faint ones at base, a second strong pair about 1 cm or so above the base, lower leaf-surface minutely black-punctate .....*P. nigrum*
4. Leaves with 2 pairs of principal nerves arising basally, lower leaf-surface not strongly punctate .....*P. betle*
3. Leaves with all principal nerves arising basally, or near base .....5
5. Principal nerves 5 or 7, climbers rooting at nodes .....6
6. Leaves commonly longer than wide, never peltate, if almost as broad as long (juvenile) then slightly puberulent beneath near base and on petiole, mature spikes commonly as long as or longer than leaves, peduncle usually longer than petiole ....*P. ponapense*
6. Leaves as broad as long, often peltate, never puberulent beneath, mature spikes much shorter than leaves, especially pistillate ones, peduncle commonly shorter than petiole .....*P. fragile*
5. Principal nerves 9–13, shrubs or climbers .....7
7. Shrubs with orbicular-cordate leaves, rather shortly pointed, equilateral at base, spikes less than 10 cm long .....*P. methysticum*
7. Climber with leaves broadly oblong-ovate to ovate, inequilateral at base, prominently pointed, spikes about 15 cm or more long .....*P. hosokawae*

*Piper betle* L.

*Piper betle* L., Sp Pl. 28, 1753 [type from Ceylon, Hermann, not seen by us].—Endlicher, Ann. Wien. Mus. Naturgesch., 1:164, 1835.—Christian, The Caroline Islands, 337, 350, 1899.—Volkens, Bot. Jahrb., 31:461, 1901.—Safford, Contr. U.S. Nat. Herb., 9:224, 353–354, 1905.—von Prowazek, Deutschen Marianen, 115, 1913.—Merrill, Phil. Jour. Sci. Bot. 9:72, 1914.—Kanehira, Enum. Micr. Pl., 304–305, 1935.—Okabe, Nettarei Sangyô Kenkyû-sho ihô, 5:2, 1940; Jour. Anthropol. Soc. Nippon, 56:424, 1941.—Tuyama, Kagaku Nanyô, 4(1):16, 1941.—Bryan, Plants of Guam [unpub., 1946?].—Glassman, Bishop Mus. Bull., 209:54, 1952.—Yuncker, Occ. Pap. Bishop Mus., 22:90–91, 1959.—Fosberg, Phytologia, 13:234, 1966.—Fosberg, Falanruw, and Sachet, Smithsonian Contr. Bot., 22:20, 1975.

*Chavica betle* (L.) Miquel, Syst. Pip., 228, 1843.

*Piper betel* L. ex Endlicher, Ann. Wien. Mus. Naturgesch., 1:164, 1835 [sphalm.].

Climber with broadly cordate to ovate-oblong leaves, aromatic and somewhat acrid to taste when crushed, main nerves 9, the outermost pair much weaker than the others, the innermost pair diverging from the midrib 1–2 cm above the base, more or less alternate, the rest basal; flowers dioecious, in oppositi-folious pedunculate spikes that are usually shorter than the leaves, staminate

spikes with bracts imbricate, pistillate spikes much shorter and thicker than staminate, densely tomentose, about 6–8 mm thick, stamens 2, stigmas 5–7; fruits coalescent and somewhat embedded in rachis.

Found generally in the Indo-Pacific region from India as far east as the betel nut (*Areca catechu* L.) is chewed, that is, to New Guinea, Western Melanesia and Western Micronesia; usually planted or persisting from plantings, around old dwelling sites and gardens.

This is a very complex or variable species, as examination of the material in almost any large herbarium of tropical plants will show. No modern attempts to analyze and classify the variations have come to our attention. We have not tried to do this for the species as a whole, but have admitted three forms in Micronesia, all of which have been previously recognized as separate species or varieties, but which were placed in two varieties by Yuncker (1959:90–91). Of the two species that were based on Micronesian material, one has been reduced to lower rank, to include the broad-leafed Marianas specimens, while the other is placed in the synonymy of the typical form.

Key to Micronesian Forms of *Piper betle*

1. Leaves somewhat oblong-ovate, with base oblique, not deeply cordate..... **f. *betle***
1. Leaves broadly ovate-cordate, acuminate, base deeply cordate, not conspicuously oblique.
  2. Leaves puberulent beneath, at least on nerves..... **f. *densum***
  2. Leaves glabrous beneath..... **f. *marianum***

Several references, as well as one specimen, examined years ago, which cannot be referred to one of the three forms, are listed below under the species. Local uses and vernacular names, likewise, are listed together under the species, with no attempt to segregate them by forms.

USES.—“Natives chew a combination of fresh *P. betle* leaves, a piece of the fragrant seed of the *Areca* palm, and a pinch of quicklime. Betle-chewing has not developed to any extent in Polynesia, where the *P. methysticum* beverage called kava apparently takes its place” (Yap: Yuncker, 1959: 91). “The fresh green leaves (manaon) are chewed by the natives wrapped around a fragment of *Areca* nut together with a pinch of quicklime” (Guam: Safford, 1905:354). “Used with lime and *Areca*-nut” (Guam: Perez in 1962). “Used in betel chewing” (Rota: Fosberg 31877).

## VERNACULAR NAMES.—

pupúlo (Marianas: von Prowazek, 1913; Safford, 1905; Merrill, 1914)  
 pupúlu (Marianas: von Prowazek, 1913)  
 pupúlu (Guam: Seale in 1900, Safford, 1905)  
 pupulo (Guam: Whiting P. 10, Perez in 1962)  
 populo (Guam: B. C. Stone 5126)  
 haboi or kaboi (Sonsorol: Berry 90)  
 a-kabui (Palau: Okabe, 1940)  
 kabúi (Palau: S. Walleser in Tuyama, 1941)  
 kebui (Palau: D. Otobed, 1967)  
 gabúi (Yap: Volkens, 1901; Yuncker, 1959; Wong 484)  
 gabusy (Yap: Cushing 660)  
 gogoth (Yap: Christian, 1899)  
 habui (Fais, Evans 357)  
 tuh (Ponape: Glassman, 1952)  
 betel pepper: English



MARIANAS ISLANDS.—Endlicher, 1835:164 (Lesson specimen); von Prowazek, 1913:115. Sarigan: *Kanehira* 2161 (FU).

***Piper betle* L. f. *betle***

*Piper betle* L., Sp. Pl., 28, 1753 [sensu stricto].

This is very variable in leaf shape but there seems to be no order to the variation, so it is difficult to separate the glabrous Marianas plants as Opiz did in his *P. marianum* (vide infra), except on leaf width and prominence of cordate base. The typical form is here restricted to plants with rather oblong-ovate leaves, shallowly cordate at base.

**GEOGRAPHIC RECORDS AND SPECIMENS EXAMINED**

MARIANAS ISLANDS.—Yuncker, 1959:90 (as *P. betle*).

Agrigan: *Hosokawa* 8009 (A), 8011 (A).

Alamagan: *Anderson* 418 (US); "Chalan nitiput," s.s.w. coast, *Falanruw* 1929 (US).

Sarigan: Hole in savanna plateau above village, 350–375 m, *Evans* 2371 (US, UH, Fo, K).

Saipan: *Hosokawa* 6658 (A); *Kanehira* 892 (BISH); *Kanehira*, 1935:305 (as *P. betle*); Mt. Tagkochao, *Stone* 5424 (US).

Rota: Slopes above As Malote, south side of island, *Fosberg* 31877 (US).

Guam: *G.E.S.* 190 (US, BISH); Mt. Tenjo, 300 m, *Bryan* 1248 (US, BISH, FU); Mangilao, *Perez* in 1962 (UG).

CAROLINE ISLANDS.—Yap: *Gagil*, *Cushing* 660 (US, Fo).

***Piper betle* f. *densum* (Blume) Fosberg**

*Piper betle* f. *densum* (Blume) Fosberg, *Phytologia*, 13:235, 1966.

*Piper densum* Blume, *Verh. Batav. Gen.* 11:193, fig. 18, 1826 [type from Java, Blume, not seen by us].

*Piper betle* var. *densum* (Blume) C. de Candolle in de Candolle, *Prodr.*, 16(1):360, 1869.—Yuncker, *Occ. Pap. Bishop Mus.*, 22:90–91, 1959.

Leaves puberulent beneath on nerves.

Found in Micronesia in the Marianas (Alamagan and Guam) and in the Carolines (Sonsorol, Palau, Yap, Fais), and said to be on Ponape.

**GEOGRAPHIC RECORDS AND SPECIMENS EXAMINED**

MARIANAS ISLANDS.—Yuncker 1959:90–91 (as *P. betle* var. *densum*); *Gaudichaud* 77 bis (P).

Alamagan: Partido village, *Fosberg* 31667 (US, BISH, Fo, DPU); SSW coast, 500 ft [150 m], *Falanruw* 1914 (US).

Guam: *Nelson* 49 (BISH); *Whiting* P10 (Fo, US); Agaña, *Seale* in 1900 (BISH); Umatac water point, 100 m, *Fosberg* 35412 (US, BISH, Fo, DPU); Mt. Santa Rosa, *Glassman* 149 (Fo); Dededo, 100 m, *Evans* 721 (US).

CAROLINE ISLANDS.—*Kanehira*, 1935:305; Yuncker, 1959:91 (as *P. betle* var. *densum*).

Sonsorol: *Berry* 90 (US, UH) (puberulence only evident on very young leaves, leaf bases somewhat oblique).

Palau: Babeldaob: Ogiwaru, east coast, *Takamatsu* 1429 (BISH); Marikyoku (Melakiok), *Kanehira* 453 (FU). Angaur: East side, 3–5 m, *Fosberg* 31995 (US).

Yap: Volkens, 1901:461 (citing Volkens 303, not seen by us); 40 ft [12 m], *Wong* 484 (US, Fo); Gorror I., central plateau, 100 ft [30 m], *Hosaka* 3307 (US, BISH).

Fais: Lochochoy, 5 m, *Evans* 357 (US, Fo) (leaves not very deeply cordate).

Ponape: *Glassman*, 1952:54 (plant observed, not collected).

***Piper betle* f. *marianum* (Opiz) Fosberg**

*Piper betle* f. *marianum* (Opiz) Fosberg, *Phytologia*, 13:235, 1966.

*Piper marianum* Opiz in Presl, *Rel. Haenk.*, 1:159, 1828 [type from Guam, Haenke, not seen by us].—Endlicher, *Ann. Wien. Mus. Naturgesch.*, 1:164, 1835.—Kunth, *Linnaea*, 13:574, 1839; *Ann. Sci. Nat. II, Bot.*, 14:179, 1840.—Safford, *Contr. U.S. Nat. Herb.*, 9:354, 1905.

*Piper potamogetonifolium* Opiz in Presl, *Rel. Haenk.*, 1:156, 1828 [type from Guam, Haenke, not seen by us].—Endlicher, *Ann. Wien. Mus. Naturgesch.*, 1:164, 1835.—Safford, *Contr. U.S. Nat. Herb.*, 9:335, 1905.—Merrill, *Phil. Jour. Sci. Bot.*, 9:72, 1914.—*Kanehira*, *Enum. Micr. Pl.*, 305, 1935.—Yuncker, *Occ. Pap. Bishop Mus.*, 22:83, 1959.—Fosberg, *Phytologia*, 13:235, 1966.

*Macropiper potamogetonifolium* (Opiz) Miquel, *Syst. Pip.*, 218, 221, 1843–1844.

*Piper betle* ♂ *marianum* C. de Candolle, *Prodr.*, 16(1):360, 1869 [based on *P. mariannum* Opiz, which is a misspelling of *P. marianum* Opiz].

A broad-leafed, deeply cordate glabrous form.

This has seldom been collected, at least in Micro-



nesia. Its range extends to the Bonins and probably to other parts of the area of the species.

#### GEOGRAPHIC RECORDS AND SPECIMENS EXAMINED

MARIANAS ISLANDS.—Endlicher, 1835:164 (Haenke specimen of *P. potamogetonifolium*).

Saipan: *Hosokawa* 6658 (A).

Guam: Opiz, 1828:156, 159 [citing Haenke, types of *P. marianum* and *P. potamogetonifolium*, not seen by us].—Endlicher, 1835:164 [Haenke specimen of *P. marianum*].—Kunth, 1839:574, 1840, 179; Miquel, 1843–1844:218; Merrill, 1914:72 (“Collected in Guam by Haenke . . .”); Barrigada Village, *Stone* 5126 (US, BISH, UG).

#### *Piper fragile* Benth

*Piper fragile* Benth in Hooker, London Jour. Bot., 2:234, 1843 [type from New Guinea, Hinds, not seen by us].—Kanehira, Enum. Micr. Pl., 305, 1935.—Yunker, Occ. Pap. Bishop Mus., 22:92–93, 1959.—Stone, Pac. Sci., 13:100, 1959. *Piper carolinense* Hosokawa, Trans. Nat. Hist. Soc. Formosa, 25:117, 1935 [type from Palau, *Hosokawa* 7505].—Kanehira, Kagaku Nanyô, 4:16, 1941.

*Piper trukense* Hosokawa, Jour. Jap. Bot., 13:200, 1937a [type from Truk, *Hosokawa* 8459]; Bull. Biogeogr. Soc. Japan, 7: 188–189, 1937b.

Glabrous vine, rooting at nodes; leaves orbicular to broadly oval or broadly elliptic, somewhat acuminate, base rounded to cordate or peltate, peltate and cordate or rounded bases on same plant, peltate more often on sterile branches, nerves usually 7, lowest pair reduced, lowest two pairs basal or sub-basal, third pair emerging from midrib slightly above base; flowers dioecious, in spikes usually shorter than leaves, opposite them, staminate spikes slender, linear, several cm long, pistillate much shorter, oblong or linear oblong; stamens 2, anthers apparently trilobular (bilobular according to Benth); stigmas 4–5, spreading to recurved; fruit globose, more or less fused with bracts and rachis.

A rather uniform species. *Piper trukense* Hosokawa from Truk, and *P. carolinense* Hosokawa, from Palau, do not seem to differ significantly.

Known from New Guinea (Hinds, type), Borneo (?), Philippines, and Micronesia; in Micronesia known from the Western and Central Carolines, including Truk, Palau, and many of the atolls. Common, covering ground and tree trunks in dense lowland forest.

USES.—Used as “baby medicine,” for bruises, as

tonic; small green flowers for maremar [garlands] (Ifaluk: *Abbott and Bates* 86).

#### VERNACULAR NAMES.—

kesebebu (Palau: *Tuyama*, 1941:16)

walitogu (Woleai: *Alkire* 81)

hatogobwei (Woleai: *Alkire* 17)

gatogobwei (Ifaluk: *Abbott and Bates* 86)

hata ho bue (Ifaluk: *Fosberg* 47216)

atobuei (Satawal: *Fosberg* 46907)

adogobwe (Namonuito: *Stone* 2079)

anes (Nomwin: *Evans* 1115)

atukupui (Nomwin: *Fosberg* 24580)

atukupwi (Nomwin: *Evans* 1066)

ootikk (Truk: *Hosokawa*, 1937b:189)

(Moen, Dublon, Udot, Tol).

ötik (Truk: Moen: *Pelzer* 85)

enes (Truk: *Wong* 170)

ères (Truk: *Pis*: *Fosberg* 24688)

atopui (Etal: *Anderson* 2063); (Satawan:

*Anderson* 1104)

atoopwei (Namoluk: *Marshall* 15)

#### GEOGRAPHIC RECORDS AND SPECIMENS EXAMINED

CAROLINE ISLANDS.—Palau: *Kanehira* 466 (FU); Kasioru, *Takamatsu* 1500 (BISH). Babeldaob: Airai, ¼ mi [0.4 km] behind airport terminal, *Salsedo* 223 (US). Koror: *Kanehira* 341 (FU); *Tuyama* in 1939 (TI); Meiung, *Salsedo* 313 (US). Urukthapel (Urktale): “in a forest on coral islet of Urktale (Todai-san),” *Hosokawa* 7505 (BISH, A, isotypes of *P. carolinense* Hosokawa, cited by Hosokawa, 1935:117); Tôdai-yama, *Kanehira & Hatusima* 4671 (FU). Malakal: Ngerungsiil, *Hardy* 57 (US, Fo). Ng’edobel: North of Eil Malk I., *Fosberg* 50566 (US, BISH, Fo, NY, Y). Bairakaseru (North of Peliliu): *Koch* 1152 (Fo). Peliliu: *Hosokawa* 9219 (A, BISH), 9212 (BISH); *Kanehira & Hatusima* 4782 (FU); *Takamatsu* 1789 (BISH). Angaur: *Takamatsu* 1806 (BISH); ridge on northwest corner of island, *Fosberg* 25948 (US, BISH, Fo, NY, DPU).

Sonsorol: *Berry* 9 (US).

Woleai: Utagal I., 12 m, *Wong* 21 (US, BISH, Fo, NY, DPU); Falalis I., *Alkire* 81 (US, Fo), *Alkire* 17 (US).

Faraulap: 2 m, *Fosberg & Evans* 47330 (US, Fo).

Ifaluk: Falarik, east coast, *Abbott and Bates* 86 (US, BISH); Ifaluk I., 2 m, *Fosberg* 47216 (US, UH, Fo, NY, L), *Fosberg* 47214 (US, BISH, Fo, NY, L, P, TI, A, QLD, K, G).

Satawal: interior of island, 2 m, *Fosberg 46907* (US, Fo).

Puluwat: 1–3 m, *Niering 764* (US).

Namonuito: Ulul I., *Stone 2079* (BISH); Ono, village and vicinity, 0–3 m, *Evans 1013* (US); *1024* (US); Piseras Island, beach and rampart, 0–3 m, *Evans 910* (US, UH, Fo, K); main taro pit, 3–5 m, *Evans 888* (US, BISH, Fo, MO); Magur, center of island, 3–5 m, *Evans 949* (US, UH, Fo); *941* (US, UH, Fo, K); Onari I., village and vicinity, 0–3 m, *Evans 984* (US).

Murilo: Rui I., interior of island, 3–5 m, *Evans 1198* (US).

Nomwin: Nomwin I., 1–2 m, *Fosberg 24580* (US, BISH, DPU); woods behind village, 0–3 m, *Evans 1066* (US); Fananu I., interior of island, 3–5 m, *Evans 984* (US).

Truk: *Wong 170* (US, Fo); Huyôtô, *Kanehira 4262* (FU); Melot, *Hosokawa 8355* (A); Tadiu, *Hosokawa 8396* (A, BISH). Moen (Wara): Mt. Tukuman, *Hosokawa 8459* (US, BISH, A, isotypes of *P. trukense*, cited by Hosokawa, 1937a:200, 1937b:188–189 as from Mt. Tratyau); *Pelzer 85* (US, BISH, Fo); east end of island, 100–200 m, *Evans 774* (US, UH, Fo), *778* (US), *791* (US, BISH), *792* (US, UH, Fo); west coast, Muam village, 15 m, *Fosberg & Pelzer 26019* (US, BISH, Fo, NY, L, DPU). Dublon (Natusima): *Hosokawa 6521* (A); Mt. Troman, Trowasi, *Hosokawa 8500* (US, A, BISH). Tol: *Hosokawa 8293* (cited by Hosokawa 1937b:189, not seen by us); Mt. Tumuital (Uiniboet), 200–460 m, *Fosberg 24451* (US, BISH, Fo, DPU). Udot: Mt. Witonnap, *Hosokawa 8355* (cited by Hosokawa, 1937b:189, not seen by us, perhaps the same as specimen of the same number cited above). Pis: 1–2 m, *Fosberg 24688* (US, BISH, Fo, NY, DPU); center of island, 3–5 m, *Evans 844* (US), *846* (US), *836* (US).

Nama: center of I., 3–5 m, *Evans 1319* (US) (juvenile).

Namoluk: Leor village, *Anderson 913* (US, BISH, Fo, DPU); 5 m, *Mac Marshall 15* (US).

Etal: Etal I., *Anderson 2063* (US, BISH, Fo, DPU).

Lukunor: Piafö I., *Anderson 2198* (US, BISH, Fo, DPU); Saponöch I., *Anderson 2204* (US, BISH, Fo, NY, DPU).

Satawan: Satawan I., *Anderson 1104* (US, BISH, Fo, NY, L, DPU); Moch I., *Anderson 1106* (US, BISH, Fo, NY, DPU).

## *Piper guahamense* C. de Candolle

*Piper guahamense* C. de Candolle in de Candolle, Prodr., 16(1):336, 1869 [type from Marianas, doubtless Guam, *Gaudichaud 163*].—Safford, Contr. U.S. Nat. Herb. 9:354–355, 1905.—Merrill, Phil. Jour. Sci. Bot., 9:71, 1914.—Kanehira, Fl. Micr., 418, 1933.—Hosokawa, Trans. Nat. Hist. Soc. Formosa, 25:117, 1935.—Kanehira, Enum. Micr. Pl., 305, 1935.—Bryan, Plants of Guam [unpub., 1946?].—Yuncker, Occ. Pap. Bishop Mus., 22:86–87, 1959.—Fosberg, Phytologia, 13:235–236, 1966.—Fosberg, Falanruw, and Sachet, Smithsonian Contr. Bot., 22:21, 1975.

*Piper latifolium* Gaudichaud ex Kunth, Linnaea, 13:575, 1839 [type from the Marianas, *Gaudichaud 163*] [non L.f., Suppl. Pl., [468], 1781].

*Macropiper latifolium* sensu Miquel, Syst. Pip., 219, 1843–1844 [non (Forster f.) Miquel, Comment. Phytogr., 36, 1840].

*Macropiper methysticum* Miquel, Syst. Pip., 217, 1843–1844 [non (Forster f.) Miquel, Comment. Phytogr., 36, 1840].

*Piper macgillivrayi* sensu von Prowazek, Deutschen Marianen, 115, 1913 [non C. de Candolle in Seemann, Fl. Vit., 262, 1868].

Erect to somewhat reclining shrub 1–3 m long, nodes prominent; leaves large, orbicular-cordate, slightly acuminate, 9- or 11-nerved from base, petioles shorter than blades, lower half expanded-sheathing; flowers dioecious or rarely monoecious, in solitary axillary pedunculate spikes, these usually shorter, sometimes longer, than the leaves, the staminate more slender than the pistillate, occasional spikes mixed, staminate and pistillate, petate bracts imbricate when spikes are young; stamens 3, oval, bilocular; ovaries subtruncate at apex, crowded on spikes, rarely a few on staminate spikes (*Rodin 613*), stigmas 3–4, fleshy, tomentose; fruits connate, red.

Marianas records of *Piper macgillivrayi* C. de Candolle by von Prowazek (1913), *Piper latifolium* Gaudichaud by Kunth (1839), *Macropiper latifolium* Miquel by Miquel (1843–1844), and *Macropiper methysticum* Miquel by Miquel (1843–1844) are doubtless based on specimens of *P. guahamense*, although we have not seen these specimens, except that of Gaudichaud. None of these species is otherwise known from the Marianas.

The species is endemic to the Marianas, where it grows as an undergrowth shrub, in and around the edges of wet forests.

Two forms are known, one with leaves prominently puberulent beneath especially on nerves, petioles, peduncles, and young stems also puberulent, the other glabrous except the stigmas.



Key to Forms of *Piper guahamense*

Leaves glabrous beneath .....	f. <i>glabrum</i>
Leaves puberulent beneath .....	f. <i>guahamense</i>

The following uses and vernacular names are listed with no attempt to segregate them to apply to particular forms.

USES.—Root used to cure gonorrhea (Rota: Yuncker, 1959:87).

## VERNACULAR NAMES.—

pupúlon anite (Rota: Fosberg 25013)

pupulan-aniti (Guam: Fosberg 46252)

pupúlo aneti (Guam: Seale in 1900)

pupúlo aniti (Guam: Nelson 5)

pupúlu ito (Guam: Seale in 1900)

*Piper guahamense* f. *glabrum* (Yuncker) Fosberg

*Piper guahamense* f. *glabrum* (Yuncker) Fosberg, Phytologia, 13:236, 1966.

*Piper guahamense* var. *glabrum* Yuncker, Occ. Pap. Bishop Mus., 22:87–88, 1959 [type from Rota, Fosberg 25036].

Leaves glabrous beneath.

Found on Agrigan, Tinian, Rota, and very rarely on Guam.

Although the ranges of this and the puberulent form are partially distinct, the trivial nature of the distinction suggests that the category of forma would be more appropriate than varietas. One sheet of G.E.S. 387 in the U. S. National Herbarium is puberulent, and was determined by Yuncker as *P. guahamense*; another in the Bishop Museum is glabrous and was a part of the basis for Yuncker's var. *glabrum*. The latter sheet is the only basis for ascribing var. *glabrum* to Guam. However, there seems no reason to doubt the locality of the sheet.

## GEOGRAPHIC RECORDS AND SPECIMENS EXAMINED

MARIANAS ISLANDS.—Yuncker, 1959:87–88 (as *P. guahamense* var. *glabrum*).

Agrigan: Hosokawa 8011 (BISH).

Tinian: Ohtani 136 (FU).

Rota: Kanehira 1753 (FU), 1788 (FU), 3619 (FU); Necker R113 (US); 50 ft [15 km], Grether 4425 (US);  $\frac{3}{4}$  mile [0.6 km] east of Sabana, 2nd terrace from top, 420–450 m, Fosberg 25036 (BISH, type, US, Fo, NY, DPU, isotypes); near Sinapal, Hosokawa 7568 (A, BISH); 2nd main terrace from top, 320 m, Fos-

berg 31855 (US, BISH, DPU); between Rota and Tataacho Pt., Fosberg 25013 (US, DPU); Shinapatu, 150 ft [45 m], Hosaka 3045 (US, BISH, DPU); Sabana, Kondo in 1952 (BISH); 400 m, Evans 2237 (US, BISH, Fo, K); main road to Sabana from airport road, 200–400 m, Sachet 1772 (US, Fo).

Guam: G.E.S. 387 part (BISH).

*Piper guahamense* C. de Candolle f. *guahamense*

*Piper guahamense* C. de Candolle in de Candolle, Prodr., 16(1):336, 1869.

Leaves and younger parts prominently puberulent.

Confined to Rota and Guam, so far as known, and the common form on Guam.

## GEOGRAPHIC RECORDS AND SPECIMENS EXAMINED

MARIANAS ISLANDS.—s.l. Gaudichaud 163 (P, type).

Rota: Middle level plateau above Tataacho Point, 150–250 m, Evans 2058 (US, BISH, Fo, K).

Guam: s.l., LeGuillou in 1839 (P); Hombron in 1839 (P, 2 sheets); G.E.S. 387 part (US); Nelson 5 (US, BISH); Marche 101 (P); Merrill, 1914:71; Mt. Lamlam, summit, 400 m, Anderson 144 (US, BISH), 318 (US, BISH, Fo, DPU); Harmon-Barrigada road, west slope, Barrigada Hill, Stone 3782 (UG); east edge of Barrigada Point area, 400–600 ft [120–180 m], Moore 7 (US); Ritidian Point, 400 ft [120 m], Hosaka 3089 (US, BISH); Necker 159 (US); near Talisay, 150 m, Fosberg 35263 (US, BISH, Fo, NY, DPU), 150 m, Fosberg 35264 (US, BISH, Fo, DPU); Yigo, Whiting P10a (US, Fo); headwaters of Ylig River, Rodin 613 (US); Agaña, Seale in 1900 (BISH); Talofoto area, Pedrus 23 (BISH); Naval Magazine, Almagosa Springs Road, Stone 4105 (UG); Canada, Bryan 1074 (US, BISH); Maguao, 15 m, limestone, Bryan 1036 (US, BISH); Mogfog, 400 ft [120 m], Gressitt 2007 (US); southwest of Anao Point, 200 m, Fosberg 31938 (US, BISH, Fo, NY, L, DPU); one mile south of Taguac, 110 m, Fosberg 35478 (US, BISH, Fo, NY, L, DPU);

Mataguac, *Reid Moran 4438* (BISH, US, Fo, UC, MO); Anigua, 4 m, *Fosberg 31214* (US, BISH, Fo, NY, L, DPU); near Mt. Tenjo, *Swezey* in 1936 (BISH); Tailalo, *Reid Moran 4581* (US, BISH, Fo, UC); Andersen Air Force Base, *Reid Moran 4404* (US, BISH, Fo, UC); north of northwest strip, *Conover & Wagner 563* (BISH); Tarague Beach, Andersen Air Force Base, 0–25 m, *Evans 731* (US, BISH, Fo, K); Lujuna, just off route 15, 180 m, *Evan 1579* (US, UH, Fo, K, Mo, L); Dededo Well Field, 110 m, *Evans 1692* (US, Fo, UH, K, P); Mt. Lamlam, track from Jumullong Manglo, 300–405 m, *Evans 237* (US, Fo, P, L, BISH, MO); Mt. Lamlam, 370 m, *Fosberg 46252* (US, Fo, UH, A, L); *46263* (US, Fo, UH, P, L, MO).

### *Piper hosokawae* Fosberg

*Piper hosokawae* Fosberg, *Phytologia*, 13:237, 1966.

*Piper decumanum* var. *palauense* Hosokawa, *Trans. Nat. Hist. Soc. Formosa*, 28:153–154, 1938 [type from Peliliu, *Hosokawa 9226*] [non *Piper palauense* Hosokawa, *Trans. Nat. Hist. Soc. Formosa*, 25:118, 1935].—Yuncker, *Occ. Pap. Bishop Mus.*, 22:89, 1959.

*Piper majusculum* sensu Kanehira, *Enum. Micr. Pl.*, 305, 1935 [non Blume, *Verh. Bot. Gen.*, 11:210, 1826].

Coarse glabrous climber; leaves ovate or ovate-oblong, strongly and usually obliquely cordate at base, acuminate at apex, main nerves 9–11 (12–13 according to Hosokawa), diverging from midrib basally or subbasally, petiole shorter than the longer of the basal lobes of the blade, somewhat winged to about half way up; spikes pedunculate, from nearly as long as to much longer than leaves; ovary attenuate to a neck in upper part, stigmas 3, tomentulose.

This Palau plant seems sufficiently distinct from either of the two forms, one American, the other Malaysian, that were originally included in *P. decumanum* L.

Endemic to Palau, so far as known, where it grows in forests throughout the group, but not common.

### GEOGRAPHIC RECORDS AND SPECIMENS EXAMINED

CAROLINE ISLANDS.—Palau: Kanehira, 1935:305 (as *P. majusculum*); Hosokawa 1938:153–154, Yuncker, 1959:89 (both as *P. decumanum* var. *palauense*); Akoru-kaigan, *Hosokawa 7098* (BISH, A); Todai-

yama, Kanehira & Hatusima 4646 (FU); Kanehira 2027 (FU). Babeldaob: Airai, *Takamatsu 1163* (BISH); Marikyoku [Melekiok], *Kanehira 392* (FU); Ogiwal, Hosokawa 9192 (cited by Hosokawa, 1938:153–154, not seen by us). Peleliu: *Hosokawa 9226* (BISH, A, isotypes); *Takamatsu 1784* (BISH), 1763 (BISH); *Hatusima 4742* (FU). Angaur: *Kanehira 568* (FU).

### *Piper latifolium* L.f.

*Piper latifolium* L.f., *Suppl.*, 91 [as *P. methysticum* corrected to *P. latifolium* in Emendanda, p. [468] at end of book] 1781 [type from Tahiti, no collection mentioned].—Fosberg, *Phytologia*, 13:236–237, 1966.

*Piper micronesiacum* Hosokawa, *Trans. Nat. Hist. Soc. Formosa*, 32:287, 1942 [type from Kusaie, *Hosokawa 9498*]; Yuncker, *Occ. Pap. Bishop Mus.*, 22:86–87, 1959 [sub. *P. guahamense*].

Large shrub, to 2.5 m, leaves orbicular, to 17 × 15 cm, thin, base deeply cordate, apex acuminate, main veins 9–13 from base, slightly puberulent beneath, petiole 5–9 cm long, 1/3 to 2/3 invaginate; spikes axillary, 1–several in an axil, about 10 cm long on peduncles 1(–4?) cm long.

In habit similar to *P. methysticum* but with axillary spikes; differing from *P. guahamense* in the usually more than one spike in an axil. Found from Kusaie south to the New Hebrides and east to Tahiti and the Marquesas.\*

CAROLINE ISLANDS.—Kusaie, Mt. Keres, Mallens, *Hosokawa 9498* (A, US, isotypes of *P. micronesiacum*).

### *Piper methysticum* Forster f.

*Piper methysticum* Forster f., *Pl. Esc. Ins. Oc. Austr.*, 76, 1786 [type from cultivation in the Society, Friendly, or Sandwich islands, collected by Forster, not seen by us].—Christian, *Caroline Islands*, 188–193, 329, 348, 1899.—Kanehira, *Fl. Micr.*, 81–82, pl. 14, 1933; *Enum. Micr. Pl.*, 305, 1935.—Hoshino, Guntô no Sangyô [1934]:[1–11, 1934].—Smith, *Jour. Arn. Arb.*, 24:353, 1943.—Glassman, *Res. Rev.*, 1950:16–18, 1950; *Bishop Mus. Bull.*, 209:55, 1952.—Massal

\* Since the above was written, Professor A. C. Smith has shown us photographs indicating that the hairs along the nerves on the underside of the leaf blade of *P. micronesiacum* are similar to those of *P. guahamense* rather than to those of *P. latifolium*. He is inclined to associate *P. micronesiacum* with *P. guahamense*. Our inclination would be, on the basis of this observation, to regard both *P. micronesiacum* and *P. guahamense* as varieties of *P. latifolium*, but we prefer to give the matter further study.



and Barrau, S. Pac. Comm. Techn. Pap., 94:44, 1956.—Yuncker, Occ. Pap. Bishop Mus., 22:88–89, 1959.—Fosberg, Phytologia, 13:238, 1966.

*Macropiper methysticum* (Forster f.) Miquel, Comment. Phytogr., 36, 1840.

Large shrub (to 50 ft [15 m] according to Glassman 1950), nodes prominent; leaves large, orbicular-cordate, slightly acuminate, nerves 11 or 13, from base except inner pair which issue from midrib 1–2 cm above base, petioles and veins beneath very shortly but densely puberulent, margin ciliate, petiole 2–3 cm long, not wing-expanded, only the extreme base sheathing, stipules lanceolate, 4–5 cm long, caducous; flowers dioecious, in pedunculate spikes mostly less than half the length of leaves, pistillate only known from Micronesia, bracts strongly imbricate when young, their margins erose or even fimbriate; ovaries obovoid, stigmas 3, flat-tish; fruit not seen.

New Guinea, Melanesia, Polynesia; in Micronesia planted or persisting from planting, possibly spontaneous, on Ponape and Kusaie. We have seen no specimens from Kusaie, but do not doubt that it occurs there or at least did formerly. Guam records probably apply to the superficially similar *P. guahamense*. Christian (1899:348), gives the names *langil* and *thlangil* from Yap, saying they apply to “a variety of the wild kava,” but since we have no record of *P. methysticum* from there, we assume that these names must apply to something else. We also doubt the authenticity of the records from Palau and Truk, as we have seen no material from either group.

ETHNOBOTANY.—Christian (1899:188–193) discusses kava-drinking, says it exists only on Ponape and Kusaie in Micronesia; he regards it as having great medicinal value. A watery infusion of the pulverized root is a widely used beverage (Yuncker, 1959:89). Account of preparation and use of “sakau” (kava), made from this plant; cites beliefs in medicinal virtues, also; banned in Kusaie by missionaries in 1850 (Ponape: Glassman, 1950:18). “There are several centres of kava drinking in the area: Ponape in the Carolines . . .” (Ponape: Massal and Barrau, 1956:44). Roots are source of beverage kava (Ponape: Glassman 2725). Root used to make drink (Ponape: Kanehira, 1935:305). Observed in common use on Ponape in 1973 (Sachet, ined.).

VERNACULAR NAMES.—

chakau (Ponape: Christian, 1899:329)

choko (Ponape: Christian, 1899:329)

sakaw (Ponape: *Gabung 1*)

sakau (Ponape: Not District, Glassman 2725; Yuncker, 1959, p. 89)

sawkaw (Ponape: Fosberg 26318)

shakau (Ponape: Kanehira, 1935:305; Kiti District, Glassman, 1952:55)

seka (Kusaie: Christian, 1899:329; Kanehira, 1933:82)

#### GEOGRAPHIC RECORDS AND SPECIMENS EXAMINED

MARIANAS ISLANDS.—Guam: *Marche 10* (P) (placed here with doubt by Yuncker but probably better referred to *P. guahamense*).

CAROLINE ISLANDS.—Palau: Babeldaob (Babelthuap): Melekiok (Marukyoku), Yuncker, 1959:88–89, citing Kanehira 453 which we refer to *P. betle* f. *densum*.

Truk: Christian, 1899:189, reports, as hearsay, that kava grows in “Hogolu or Ruk.”

Ponape: Christian, 1899:188–193, 329; Metaranium (Matalanim), Kanehira 835 (FU, BISH); *Gabung 1* (US); Colonia, Kanehira 671 (NY); Mt. Asama-san, 500–200 m, Hosokawa 9601 (A); Mt. Seletereh, 500 ft [150 m], Glassman 2725 (US, BISH); south base of Tolenot Pk., Not District, 3–10 m, Fosberg 26318 (US); Anapeng-pa, Takamatsu 708 (BISH); Tolomail, cultivated, Takamatsu 970 (BISH); Kuporujō, cultivated, Takamatsu 676 (BISH).

Kusaie: Christian, 1899:188–189; Kanehira, 1933:82; Glassman, 1952:55.

#### *Piper nigrum* L.

*Piper nigrum* L., Sp. Pl., 28, 1753.—Safford, Plant World, 5:196, 1902; Contr. U.S. Nat. Herb., 9:282, 355, 1905.—Okabe, Nettai Sangyō Kenkyū-sho ihō, 5:2, 1940.—Bryan, Plants of Guam [unpub., 1946?].—Yuncker, Occ. Pap. Bish. Mus., 22:90, 1959.

Glabrous climber with ovate to broadly elliptic leaves, obtuse to rounded at base, acuminate at apex, minutely but densely black-punctate beneath, 7-nerved, the outer pair very faint, arising at base, a second pair, much stronger, just above base, the other pairs arising well above the base, well separated, the upper strongly alternate, petiole 1–2 cm long, expanded only at extreme base; spikes pedunculate, less than 10 cm long, not equaling leaves,

pistillate flowers rather loosely arranged on rachis, ovary broadly ovoid, stigmas linear, 3, spreading, tending to be raised on an extremely short style; fruit globose, free, neither connate nor sunken in rachis (description mostly from Philippine specimens).

Widely cultivated in southeast Asia and Malesia, known to be or have been cultivated in Micronesia, on several of the high islands.

**ETHNOBOTANY.**—This is the plant that yields the black pepper and the white pepper of commerce. It has been planted on an experimental scale in several places in Micronesia, e.g., Palau (fide Okabe, 1940) and Guam (Safford, 1902); some of excellent quality is produced for sale in Ponape, called there, "Sele Soal" fide Salomon and George.

#### GEOGRAPHIC RECORDS AND SPECIMENS EXAMINED

**MARIANAS ISLANDS.**—Yuncker, 1959:90 ("No specimens seen in Micronesian collections examined").

Guam: Mangilao, Dept. Agriculture Nursery, *Falanruw* & *Barcinas* 998 (UG, US).

**CAROLINE ISLANDS.**—Palau: Koror, cultivated, *Cheatham* 168 (US); *Blackburn* 161 (US).

Ponape: Ponsakir, *Salomon* & *George* 9 (US).

#### *Piper ponapense* C. de Candolle

*Piper ponapense* C. de Candolle, Bot. Jahrb., 56:502, 1921 [type from Ponape, Ledermann 13429a, not seen by us].—Kanehira, Enum. Micr. Pl., 305, 1935.—Hosokawa, Jour. Jap. Bot., 13:199, 1937a; Bull. Biogeogr. Soc. Jap., 7:188, 1937b; Kudoa, 5:95, 1937c; Trans. Nat. Hist. Soc. Formosa, 33:120, 1943.—Riesenberg, S. W. Jour. Anthropol., 4:428, 1948.—Glassman, Bish. Mus. Bull. 209:54–55, 1952; Pac. Sci. 7:303, 1953.—Yuncker, Occ. Pap. Bish. Mus., 22:93–95, 1959.—Stone, Pac. Sci., 13:100, 1959.

*Piper kusaiense* Hosokawa, Trans. Nat. Hist. Soc. Formosa, 25:118, 1935 [type from Kusaie, *Hosokawa* 6324].—Kanehira, Enum. Micr. Pl., 305, 1935.

*Piper palauense* Hosokawa, Trans. Nat. Hist. Soc. Formosa, 25:118, 1935 [type from Palau, *Hosokawa* 7361].—Okabe, Jour. Anthropol. Soc. Nip., 56:426, 1941; Nankyô, 2:21, 1943 [as *P. palawense*].

Glabrous or subglabrous aromatic climber, rooting at nodes; leaves almost orbicular to broadly lanceolate, strongly acuminate, base rounded to cordate, petioles commonly about 1 cm long on mature plants, juvenile plants with generally broader, more cordate leaves and longer petioles,

these and basal parts of nerves often slightly puberulent, nerves usually 7, diverging at base or almost so, outer pair somewhat weaker, rarely an extra very weak outer pair; flowers dioecious, in linear elongate pedicillate spikes, usually equaling or exceeding leaves; bracts of staminate spikes imbricate; stamens 2, anthers elliptic or oblong, bilocular; stigmas 3 or 4, spreading, pubescent, easily rubbed off in age; ovaries obconical, subtruncate at apex; fruit obovoid, red, fleshy, not greatly enlarging.

Extremely variable, but *P. kusaiense* and *P. palauense* do not appear to differ in any essential respect. Broad leaved or juvenile forms, when sterile, distinguished with difficulty from *P. fragile*. A slight trace of puberulence on the petiole and under sides of the veins at the base of the leaf in juvenile material seems confined to *P. ponapense*. The petioles are also generally shorter in *P. ponapense*, but there is some overlapping in young specimens.

Found throughout the Caroline Islands (Palau, Truk, many of the atolls, Ponape, Kusaie) from lowlands to middle altitudes, in forests, thickets, and openings, creeping on ground and climbing on rocks and tree trunks.

**USES.**—Plant parts are used to alleviate stomach aches (Ponape, Truk, Ant: Glassman, 1952:55).

#### VERNACULAR NAMES.—

kasibibui (Palau: *Fosberg* 47448)  
ksebebui (Palau: *Fosberg* 25801)  
kesibibui (Palau: Okabe, 1941:425)  
keshbibbui (Palau: Okabe, 1943:21)  
tolboy (Lamotrek: *Fosberg* & *Evans* 46786)  
elek (Satawal: *Fosberg* 46897)  
enes (Truk: *Wong* 152)  
ennes (Truk: *Pelzer* 47)  
eras (Truk: *Fosberg* 24554)  
eresi (Truk: Hosokawa, 1937b:188)  
anek (Namoluk: *Marshall* 89)  
anük (Etal: *Anderson* 2062)  
anük (Lukunor: *Anderson* 2102)  
anük (Satawan: *Anderson* 1107)  
ahnuck (Ant: Glassman, 1953:303)  
kon'ok (Ponape: *Riesenberg* 40)  
ko'nok (Ponape: Yuncker, 1959:95)  
konok (Ponape: Glassman, 1952:54, 55)  
kai-fuhl (Kusaie: *Glassman* 2718)

#### GEOGRAPHIC RECORDS AND SPECIMENS EXAMINED

**CAROLINE ISLANDS.**—Palau: Babeldaob: Aimiriik,



*Kanehira & Okamoto* 18 (FU), *Kanehira* 285 (FU, BISH); *Hosokawa* 7207 (A); in a thicket along a valley near Mt. Unkeshiu, *Hosokawa* 7138 (cited by Hosokawa, 1935:118, not seen by us); Arumonogui, near Arumatan, *Hosokawa* 6748 (BISH, A); Malukyoku, Galdok (Ngardok) Kaisyalu I., *Hosokawa* 7361 (A, isotype of *P. palauense*); Garamiscan Colony, *Fosberg* 25763 (US, BISH, Fo, NY, DPU, L); Kamsetsu, *Takamatsu* 1120 (BISH); Kasioru, *Takamatsu* 1507 (BISH); Kaiguru, *Takamatsu* 1590 (BISH). Koror: *Kanehira* 196 (FU); in a forest on coral at Almizu, *Hosokawa* 7407 (cited by Hosokawa, 1935:118, not seen by us). Ngarakabesang (Arakabesan): *Takamatsu* 1246 (BISH); south side of west peninsula of island, 20–30 m, *Fosberg* 32132 (US, BISH, Fo, DPU). Aulupse'el: Ngar Malk, 1–10 m, *Fosberg* 32616 (US, BISH, Fo, NY, DPU), *Fosberg* 32617 (US, BISH, DPU); Dü'ebachel beach, east end of island, 2 m, *Fosberg* 47448 (US, UH, Fo, MO, K, NY); Ngeremengii, Trail from bauxite mining area to school, *Falanruw*, *Fosberg*, et al. 1058 (US). Ngeanges (Gaiangas): Island west of south point of Urukthapel, *Fosberg* 25801 (US, BISH, Fo, DPU). Peliliu: *Takamatsu* 1788 (BISH); *Kanehira & Hatusima* 4779 (FU). Angaur: East side, *Fosberg* 31989 (US).

Lamotrek Atoll, Lamotrek Islet, interior of island, 1–3 m, *Fosberg & Evans* 46786 (US).

Satawal: interior of island, 2 m, *Fosberg* 46897 (US, BISH, Fo).

Puluwat Atoll: 1–3 m, *Niering* 768 (US).

Namonuito: Ulul I., *Stone* 2078 (BISH).

Murilo: Murilo I., 3–5 m, *Evans* 1241 (US), 1240 (US); Ruo I., interior of island, 3–5 m, *Evans* 1193 (juvenile) (US), 1202 (US); main taro pit, 1176 (US, UH, Fo, K, MO); observed, not collected (Stone, 1959:100).

Nomwin: Nomwin I., observed, not collected (Stone, 1959:100).

Truk: *Wong* 152 (US); Tadiu, *Hosokawa* 8401 (BISH, A, US); Akisima, *Kanehira* 3872 (FU), 3877 (FU); Uoala, *H. F. Moore* 114 (US). Moen: *Kanehira* 1716 (FU); *Pelzer* 47 (US); 48 (US); near Baker Dock, 3 m, *Fosberg* 24704 (US, BISH, Fo, DPU), *Fosberg* 24697 (US, BISH, Fo, DPU); south slope of Mt. Tonaachau, *Fosberg* 26053 (US, BISH, Fo, DPU, NY, L); *Daniells* 100 (US); track leading to highest point on island, 100–400 m, *Evans* 1265 (US, BISH, Fo); 1284 (US, BISH). Dublon (Trowasi, Natusima): *Hosokawa* 8362 (BISH); Mt. Tolomen

(Tolowan), 200–360 m, *Fosberg* 24554 (US, BISH, Fo, NY, DPU); Mt. Tumuital (Uiniboet), 200–460 m, *Fosberg* 24444 (US, BISH, Fo, NY, DPU). Tol: *Hosokawa* 8327 (A, BISH); 300 m, *Kanehira* 1288 (FU); Uriribot, *Hosokawa* 8269 (BISH, A), 8292 (BISH, A).

Losap: Seen but not collected by Anderson in 1949; Losap I., interior of island, 3–5 m, *Evans* 1342 (US, UH).

Namoluk: Seen but not collected by Anderson in 1949; Namoluk Islet, 2–3 m, *Marshall* 89 (US).

Etal: Etal I., *Anderson* 2062 (US, BISH, Fo, DPU).

Lukunor: Lukunor I., *Anderson* 2167 (US, BISH, Fo, NY, DPU); Oneop I., *Anderson* 2102 (US, BISH, Fo, NY, L).

Satawan: Moch I., *Anderson* 1107 (US, BISH, Fo, NY, L, DPU).

Ant: observed as an epiphyte by Glassman (1953: 303).

Ngatik (Natik): *Kanehira* 4120 (FU).

Ponape: *Ledermann* 13266 (BISH); *Kanehira* 672 (BISH); *Hosokawa* 5472, 5538, 5585, 5598, 5721, 5858, 5919, 6032, 6148 (all cited by Hosokawa, 1943: 120, not seen by us); *Ledermann* 13429a, type (cited by de Candolle, 1921:502, not seen by us); *Riesenberg* 40 (BISH); *H. F. Moore* 108 (US), 107 (US); Colonia, *Kanehira* 672 (US, NY, BM, FU); Palikir, *Kanehira* 721 (NY); Kiti, *Kanehira* 1539 (US, NY, FU); outlet of Tawensokola River, *Glassman* 2444 (US, BISH); Parkier, *Kanehira* 706 (FU); Mt. Kan-kauzan, *Hosokawa* 5505 (A); Nanipiru, 200 ft [60 m], *Hosaka* 3539 (US, BISH, Fo, DPU); Mt. Tolotom, *Takamatsu* 1059 (BISH); Param, *Takamatsu* 633 (BISH); Net Village, along river bank, *Salomon*, S. & T. George 57 (US).

Kusaie: *Kanehira* 1350 (FU, P); Matante, *Kanehira* 4199 (FU); Mt. Matante (Mt. Buache), *Takamatsu* 496 (BISH); lowest slope and foot of south side, 1–50 m, *Fosberg* 26566 (US, BISH, Fo, NY, DPU); Mt. Buache, *Hosokawa* 6261 (A), Taonsakku, *Hosokawa* 6324 (BISH, A, isotypes of *P. kusaiense*); Yasibayasi-Taontakku, *Hosokawa* 6215 (A); Lele I.: *Fosberg* 26543 (US, BISH, Fo, NY, L, DPU), *Glassman* 2718 (US, BISH); south slopes and ridges of Mt. Tafeyet, south of the Lele Harbor, *Fosberg* 26668 (US); Hill 541, 500 ft [150 m], *J. F. G. Clarke* s.n. (US); Mt. Fenkol (Mt. Crozer, Mt. Hinkorn, Hinkoln), 100 m, *Takamatsu* 385 (BISH); *Kanehira* 1388 (FU), 4193 (FU).

### Synonyms and Excluded or Misapplied Names

- Chavica* Miquel. See *Piper* L.  
*Chavica betle* (L.) Miquel. See *Piper betle* L.  
*Macropiper* Miquel. See *Piper* L.  
*Macropiper potamogetonifolium* (Opiz) Miquel. See *Piper betle* f. *marianum* (Opiz) Fosberg  
*Macropiper latifolium* (Forster f.) Miquel. See *Piper guahamense* C. de Candolle for Marianas records  
*Macropiper methysticum* (Forster f.) Miquel. See *Piper methysticum* Forster f., but see *Piper guahamense* C. de Candolle for Marianas records  
*Micropiper* Miquel. See *Peperomia* Ruiz & Pavón  
*Peperomia bilineata* (Blume) Miquel. See *Peperomia pellucida* (L.) Humboldt, Bonpland, & Kunth, at least for Yap record  
*Peperomia gibbonsii* C. de Candolle. See *Peperomia ponapensis* C. de Candolle var. *ponapensis*  
*Peperomia guamana* C. de Candolle. See *Peperomia mariannensis* C. de Candolle f. *mariannensis*  
*Peperomia guamana* var. *saipana* (C. de Candolle) Yuncker. See *P. mariannensis* f. *saipana* (C. de Candolle) Fosberg  
*Peperomia hoeferi* C. de Candolle. See *P. mariannensis* C. de Candolle f. *mariannensis*  
*Peperomia ladronica* Hosokawa. See *P. mariannensis* C. de Candolle f. *mariannensis*  
*Peperomia lineata* Miquel ex Yuncker. See *Peperomia pellucida* (L.) Humboldt, Bonpland & Kunth  
*Peperomia membranacea* Hooker & Arnott. See *Peperomia mariannensis* C. de Candolle for Micronesian record  
*Peperomia pacifica* Hosokawa. See *Peperomia mariannensis* f. *saipana* (C. de Candolle) Fosberg  
*Peperomia pacificicola* Hosokawa. See *Peperomia mariannensis* C. de Candolle f. *saipana* (C. de Candolle) Fosberg  
*Peperomia pallida* (Forster f.) A. Dietrich. See *Peperomia ponapensis* C. de Candolle f. *ponapensis* for Marshall Islands record  
*Peperomia pellucida* var. *obtusifolia* Koidzumi. See *Peperomia pellucida* (L.) Humboldt, Bonpland, & Kunth  
*Peperomia pellucidopunctulata* C. de Candolle. See *Peperomia mariannensis* C. de Candolle for Marianas record  
*Peperomia saipana* C. de Candolle. See *Peperomia mariannensis* f. *saipana* (C. de Candolle) Fosberg  
*Peperomia tinianensis* Hosokawa. See *Peperomia mariannensis* C. de Candolle f. *mariannensis*  
*Peperomia trukensis* Yuncker. See *Peperomia ponapensis* var. *trukensis* (Yuncker) Fosberg  
*Peperomia volkensii* C. de Candolle. See *Peperomia ponapensis* C. de Candolle var. *ponapensis*  
*Peperomia yapensis* C. de Candolle. See *Peperomia pellucida* (L.) Humboldt, Bonpland, & Kunth  
*Piper betel* L. ex Endlicher. See *Piper betle* L.  
*Piper betle* var. *densum* (Blume) C. de Candolle. See *Piper betle* f. *densum* (Blume) Fosberg  
*Piper betle* var. *mariannum* C. de Candolle. See *Piper betle* L. f. *marianum* (Opiz) Fosberg  
*Piper bilineata* Miquel ex Kanehira. See *Peperomia pellucida* (L.) Humboldt, Bonpland, & Kunth  
*Piper carolinense* Hosokawa. See *Piper fragile* Benth  
*Piper decumanum* var. *palauense* Hosokawa. See *Piper hosokawae* Fosberg  
*Piper densum* Blume. See *Piper betle* f. *densum* (Blume) Fosberg  
*Piper guahamense* var. *glabrum* Yuncker. See *Piper guahamense* f. *glabrum* (Yuncker) Fosberg  
*Piper kusaiense* Hosokawa. See *Piper ponapense* C. de Candolle  
*Piper latifolium* Gaudichaud ex Kunth. See *Piper guahamense* C. de Candolle  
*Piper macgillivrayi* C. de Candolle ex Seemann. See *Piper guahamense* for Marianas records  
*Piper majusculum* Blume. See *Piper hosokawae* Fosberg for Micronesian records  
*Piper mariannum* Opiz. See *Piper betle* f. *marianum* (Opiz) Fosberg  
*Piper marianum* Opiz. See *Piper betle* f. *marianum* (Opiz) Fosberg  
*Piper micronesiacum* Hosokawa. See *Piper latifolium* L. f.  
*Piper obtusifolium* L. See *Peperomia obtusifolia* (L.) A. Dietrich  
*Piper palauense* Hosokawa. See *Piper ponapense* C. de Candolle  
*Piper palawense* Okabe. See *Piper ponapense* C. de Candolle  
*Piper pellucidum* L. See *Peperomia pellucida* (L.) Humboldt, Bonpland, & Kunth  
*Piper potamogetonifolium* Opiz. See *Piper betle* f. *marianum* (Opiz) Fosberg  
*Piper trukense* Hosokawa. See *Piper fragile* Benth.



## MYRICACEAE

Shrubs and trees, usually aromatic; leaves simple, alternate or rarely opposite, exstipulate or with very early caducous stipules; flowers dioecious or monoecious, in catkins, subtended by bracts, reduced to small clusters of stamens or to a solitary naked pistil, ovary 1-celled, with one ovule, style very short, stigma cup-shaped, produced into two spreading flat lobes, usually regarded as two stigmas; fruit a drupe covered by waxy or fleshy peltate processes or warty, containing a single seed.

*Myrica* L.

*Myrica* L., Gen. Pl., ed. 5, 449, 1754 [=1753]; Sp. Pl., 1024, 1753.

Characters of the family.

An almost cosmopolitan genus. One species introduced into Guam from East Asia, not collected recently.

*Myrica rubra* Siebold & Zuccarini

*Myrica rubra* Siebold & Zuccarini, Abh. Akad. Muenchen IV, 3:230, 1846.—Bryan, Plants of Guam [unpub., 1946?].—Stone, Micronesica 6:245, 1971.

Tree to 15 m tall, essentially glabrous, leaves narrowly obovate to oblanceolate or somewhat spatulate, 4–12 cm long, 1–3 cm wide, apex obtuse to rounded, base cuneate-contracted, margins entire to obscurely crenate-serrate toward apex, coriaceous, under surface punctate with sessile yellow resinous glands, venation not prominent, 6–8 main veins on a side, network closely reticulate, petiole 1 cm or less long; staminate flowers in simple or branched catkins, 1-several in a leaf axil, 1–3 cm long, anthers very plump, about 1.5 mm long and wide, sessile,

several together subtended by concave glandular-ciliolate scales, pistillate catkins shorter, to 1.5 cm, solitary, minutely hirsute, flowers reduced to an ovary surmounted by an expanded cup-shaped, greatly bilobed stigma, subtended by a glandular obtuse concave bract, fruit a subglobose drupe about 10 × 7–8 mm, hirsute, closely beset with erect peltate processes that become fleshy and red when mature, endocarp hard.

MARIANAS ISLANDS.—Guam: Bryan [1946?].—Stone, 1971:245.

Said to have been introduced in 1911 (fide Stone), no Micronesian collections available, possibly no longer extant there. Description from Japanese and Ryukyu specimens.

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## Index

Accepted names are in roman type. Synonyms, missapplications, and page numbers of principal treatments are in italics.

- Areca catechu*, 17  
*Casaarina*, 1  
     *litorea*, 4  
*Casuarina*, 1  
     *equisetifolia*, 4  
     *equisetifolia* var. *souderi*, 6  
     *litorea*, 4  
     *litorea* var. *souderi*, 6  
     *mertensiana*, 4  
*Casuarinaceae*, 1  
*Chavica*, 16  
     *betle*, 17  
*Macropiper*, 16  
     *latifolium*, 20  
     *methysticum*, 20, 23  
     *potamogetonifolium*, 18  
*Micropiper*, 6  
*Myrica*, 27  
     *rubra*, 27  
*Myricaceae*, 27  
*Peperomia*, 6  
     *argyreia*, 6  
     *bilineata*, 13, 14  
     *breviramula*, 7, 8, 9  
     *caperata*, 6, 7, 8  
     *gibbonsii*, 14, 15  
     *glassmanii*, 7, 8, 9, 12  
     *guamana*, 9, 10, 11  
     *guamana* var. *saipana*, 10, 11, 12  
     *hoeferi*, 10  
     *kraemeri*, 7, 8, 9, 10  
     *kusaiensis*, 7, 9  
     *ladronica*, 10  
     *leptostachya*, 7, 9, 12  
     *lineata*, 13  
     *magnoliaefolia*, 12  
     *mariannensis*, 7, 8, 9, 10, 12, 15  
     *mariannensis* f. *mariannensis*, 10, 12  
     *mariannensis* f. *saipana*, 7, 10, 11  
     *membranacea*, 9, 10  
     *obtusifolia*, 6, 7, 12  
     *pacifica*, 11, 12  
     *pacificicola*, 11  
     *palauensis*, 7, 8, 10, 12, 16  
     *palauensis* var. *occidentalis*, 7, 13  
     *palauensis* var. *palauensis*, 12  
     *pallida*, 15  
     *pellucida*, 7, 13  
     *pellucida* var. *obtusifolia*, 13, 14  
     *pellucidopunctulata*, 9, 10, 11  
     *ponapensis*, 7, 10, 14, 15  
     *ponapensis* var. *ponapensis*, 15  
     *ponapensis* var. *trukensis*, 7, 15, 16  
     *saipana*, 11, 12  
     *sandersii*, 6  
     *tinianensis*, 10  
     *trukensis*, 14, 16  
     *volkensii*, 14, 15, 16  
     *yapensis*, 13, 14  
*Piper*, 6, 16  
     *betel*, 17  
     *betle*, 16, 17, 18  
     *betle* f. *betle*, 17, 18  
     *betle* f. *densum*, 17, 18, 23  
     *betle* var. *densum*, 18  
     *betle* § *mariannum*, 18  
     *betle* f. *marianum*, 17, 18  
     *bilineata*, 13  
     *carolinense*, 19  
     *decumanum*, 22  
     *decumanum* var. *palauense*, 22  
     *densum*, 18  
     *fragile*, 16, 19, 24  
     *guahamense*, 16, 20, 21, 22, 23  
     *guahamense* f. *glabrum*, 21  
     *guahamense* var. *glabrum*, 21  
     *guahamense* f. *guahamense*, 21  
     *hosokawae*, 16, 22  
     *kusaiense*, 24, 25  
     *latifolium*, 16, 20, 22  
     *macgillivrayi*, 20  
     *majusculum*, 22  
     *mariannum*, 18  
     *marianum*, 18, 19  
     *methysticum*, 16, 17, 22, 23  
     *micronesiacum*, 22  
     *nigrum*, 16, 23  
     *obtusifolium*, 12  
     *palauense*, 22, 24, 25  
     *palawense*, 24  
     *pellucidum*, 13  
     *ponapense*, 16, 24  
     *potamogetonifolium*, 18, 19  
     *trukense*, 19, 20  
*Piperaceae*, 6



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